

**COMPUTERS**

PC Labs Tests
21 Affordable
12-MHz 286 PCs

FIRST LOOKS

1-2-3, Release 3.0
Faster?
More Powerful?
Too Much Too Late?

CONNECTIVITY

5 Multiuser
Operating Systems
for DOS Apps

FREE UTILITY

Find Your Way
Through the Maze of
OS/2 Setup Options

VOLUME 8 NUMBER 15

THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

SEPTEMBER 12, 1989

GRAPHICAL: The Better Interface

15 leading-edge
environments deliver

- Power
- Ease of Use
- Consistency
- Multitasking

Windows
GEM
DeskMate
NewWave

OS/2 PM

Macintosh

Open Look
NeXTStep
OSF/Motif
NeWS
PM/X

Future...



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always view our monitors
in a certain way.



If you want better word processing, don't settle for Perfect.

The trouble with WordPerfect® is, sometimes it isn't. Not when you compare it to our new Microsoft® Word version 5.0. Not when you consider that with Word 5.0, you'll pump out your day-to-day jobs quicker, easier, even smarter than you ever thought possible. On your IBM® PC or 100% compatible.



Introducing new Microsoft Word 5.0. When Perfect just isn't good enough.

It doesn't get much simpler than this.

Example: With Word 5.0 you can choose commands by either using simple speed keys or just selecting from a menu.

You can tab, delete, italicize, move, change font and size, even cut and paste with about 50% fewer keystrokes than you-know-who.

Your workgroup can even make any

annotations right on a document, then you can merge and collect all the comments. WordPerfect? No comment.

You can also sort, list, search and archive files across multiple directories,

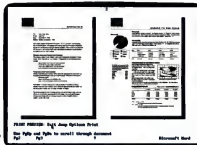
COMMON WORDPROCESSING TASKS		
Which requires fewer keystrokes?	Microsoft Word 5.0	WordPerfect 5.0
Copy Block	4	7
Delete Line	2	4
Italicize Word	2	5
Change Font and Size	6	9
Add Footer	1	7
Box Paragraph	5	12
Total	25	64

With new Word 5.0 you'll do about 50% less hunting and pecking than with WordPerfect.

on your PC or across a network, thanks to the Word 5.0 document management and retrieval system.

Or incorporate part, or all of a Lotus® 1-2-3® Microsoft Excel or Microsoft Works spreadsheet into a Word document. And then update it. In seconds.

All of which is reason enough to try new Word 5.0. But for those who need a little more



Word 5.0 Print Preview makes sure what you see is what you want. Before you print it.



REPORT TO THE FIELD

Sales per region



The following are the most recent sales figures for the Arbor regional sales office. All client and distributor requests should be directed to these numbers.

Los Angeles	887-86
Atlanta	857-96
Chicago	773-78
New York	888-13
Miami	242-75
Denver	888-75

Shoe enough

Arbor Footwear comes and goings: Jim Dearing becomes V.P. Design for Arbor Evening and Dress wear. Greg Vroonss moves from Peoria to marketing in Miami. Joan MacArthur and Lisa Dean become account supervisor and media planner, respectively. *—Angie K.*

Sales per region

Across the board it looks like the South once again led sales in FY '88. With the continuing pump crase those figures should maintain, if not improve. *—Angie K.* It's important not to let the other areas such as Northeast and Midwest fall.

Style	Dress	Sport	Casual	Canvas
Evening and	Weekender	Tallies made	Trouser slip	
Midnight moments	Richmond	Ladies wingtip	Leather	
Twilight smiles	Business up	M.B.A. trend	Specialty sneakers	
Price:	\$120-\$150	\$85-\$125	\$120-\$150	\$10-\$150

Young professionals use Arbor Walker to commute.

Soon, young professional women will no longer be using Arbor shoes simply to climb the corporate ladders. They'll be using them to get them.

This fall we're introducing the Arbor Walker — a shoe that goes quite a few steps further than the now-accepted but unattractive tennis shoe women have been wearing to and from work.

Made of Italian leather with a rubber sole, the Arbor Walker is the perfect combination of style and durability.

Look for promotional materials and carrying cases in early September. Our sales point is: "Women don't have to sacrifice looks for comfort."



Arbor Walker designed by Peter Dink.

SALES FORECAST FOR 1988

Types of shoes: Summer/Fall/Holiday/Spring

	1st quarter	2nd quarter	3rd quarter	4th quarter
Dress	95,000	87,000	120,000	60,000
Casual	43,000	82,000	60,000	90,000
Canvas	125,000	85,000	75,000	80,000
Sport	135,000	60,000	90,000	87,000
TOTAL:	398,000	314,000	345,000	317,000

Angie K. 9/22/88, 4:52 PM

let's discuss forecast for media department expansion

on 9/22/88, 4:15 PM

Figures for Northeast and Midwest should be calculated separately mid-month

let's catch them before they fall with promo.

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convincing picture this: Outline View
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CIRCLE 280 ON READER SERVICE CARD

Inside

When you turned on your PC this morning, you probably found DOS's uncommunicative C: prompt staring back at you. But sometime soon, you'll be looking at a friendly graphical user interface instead.

The benefits of GUIs—affectionately pronounced “gooey”s—are tremendous. In addition to ease of use, GUIs offer consistency across applications, shorter learning curves, and degrees of multitasking. Until recently, the advantages

GUIs offer came at a price some users couldn't pay. “GUIs are so slow,” complained Madison (Wisc.) Users Group president Denise Rall during a PC Magazine reception at Spring Comdex. The good news is that GUIs are getting faster. As contributing editor Jim Seymour says in the introduction to the cover story, recent hardware improvements leave GUI naysayers with little to criticize.

GUIs are popping up all over the PC industry. Today's GUIs come from a wide variety of companies; we rounded up graphical user interfaces from Apple, AT&T and Sun Microsystems, Brightbill-Roberts, Digital Research, Hewlett-Packard, IBM and Microsoft, NeXT, the Open Software Foundation, Quarterdeck Office Systems, Tandy, and Wang Laboratories.

Reviewing all of these products in a single story was a challenge—partly because such tried-and-true PC Magazine evaluation methods as benchmark



tests aren't appropriate for GUIs. Even project leader Bill O'Brien, who's written dozens of PC Labs scripts and tests over the past 3 years, couldn't devise one that would measure a GUI's look and feel or its ease of use. Complicating matters even further, the GUIs we wanted to look at run on different operating systems.

Executive editor Bill Howard and I turned to contributing editor Charles Petzold, author of the recently published

Programming the OS/2 Presentation Manager (Microsoft Press, 1989), to help steer our course. We invited opinions from vendors, users, contributors, and staff. Many meetings, MCI messages, and phone calls later, we had our charter. We decided that the reviews should evaluate the



Like the Brooklyn Bridge, GUIs combine form and functionality, says associate editor Mary Kathleen Flynn.

strengths and weaknesses of each GUI; show how GUIs compare; advise on who should buy what, and when; discuss applications developed for the GUI; and explain where each GUI is headed.

We also established ground rules: that a GUI is a user interface that runs in a computer's graphics mode; that we would look at every GUI with a significant presence in the PC business community; and that we'd bring our contributors together to compare notes.

In this issue's cover story, you'll find our vision of the wonderful world of GUIs. It's a world you'll see a lot of in the future. —Mary Kathleen Flynn ■

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Everything it takes to add PostScript to your LaserJet II, including HP's blessing.

"The QMS JetScript controller is the best way available to add PostScript capabilities to a Hewlett-Packard LaserJet Series II printer."

—PC Week
Sept. 19, 1988

Hewlett-Packard* and QMS* have made it easy to give your LaserJet Series II* the desktop publishing power of the PostScript* page description language.

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CIRCLE 259 ON READER SERVICE CARD

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Lori Grunin/ Turning extended memory into expanded; changing a disk's interleave; diagnosing interrupt conflicts.

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Will features such as three-dimensionality, external DBMS access, and linked file support put *Lotus 1-2-3, Release 3*, on top?

Budget Express, an add-in for *1-2-3, Release 2*, creates outlines out of budget worksheets.

SmartWareII offers the convenience of integration and the power of macro programming.

Superbase 2: An entry-level DBMS for *Windows*. *DisplayWrite 5/2 Composer* brings WYSIWYG text processing to OS/2.

Xerox Graph turns data-intensive worksheets into presentation-quality charts.

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The GUI: An Interface You Won't Outgrow

Jim Seymour/ A full palette of graphical user interfaces is poised to wipe the command line off of your PC screen. From Macintosh's Finder to OS/2's Presentation Manager to NeXTStep for Unix, GUIs offer greater power, ease of use, and consistency across applications.



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Charles Petzold, Luisa Simone, and Tami D. Peterson

Today's best GUI options run on DOS: *Microsoft Windows*, Tandy's *DeskMate*, Digital Research's *GEM/3 Desktop*, and Hewlett-Packard's *HP NewWave Environment*. But take a close look at OS/2's Presentation Manager. PM promises to be tomorrow's GUI of choice, bringing with it the next generation of powerful applications from giants like Lotus, Ashton-Tate, and Micrografx.

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Philip F. H. Rose/ No GUI roundup would be complete without Apple's Finder, the graphics-based interface that has inspired near-religious devotion among Macintosh users. As the Finder gets tweaked, will Mac fans stay tuned, or will they switch to OS/2's Presentation Manager?

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PC
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EDITOR'S CHOICE

Austin 286/12.5

January 31, 1989

PC MAGAZINE SAYS, "Austin Computer Systems has a winning combination of class parts, smart design, high performance, and aggressive pricing, all backed by a GE on-site service contract. How can you lose?"



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280/32	80 MB 28-meg. i.a.	\$2295	\$2495	\$2495	\$2495
	110 MB 28-meg. i.a.	—	—	—	—
	130 MB 28-meg. i.a. P80H	\$2095	\$1995	\$1995	\$1995
280/5X	80 MB 28-meg. i.a.	\$1995	\$2105	\$2105	\$2105
	110 MB 28-meg. i.a.	—	\$2225	\$2225	\$2225
	130 MB 28-meg. i.a. P80H	\$2195	\$2195	\$2195	\$2195
280/60	80 MB 28-meg. i.a.	\$2795	\$3295	\$3185	\$3185
	110 MB 28-meg. i.a.	\$3795	\$3795	\$3795	\$3795
	130 MB 28-meg. i.a. P80H	\$3595	\$3595	\$3595	\$3595
280/60	80 MB 15-meg. i.a.	\$3595	\$3125	\$3225	\$3225
	110 MB 15-meg. i.a.	—	—	—	—
	130 MB 15-meg. i.a. P80H	\$3395	\$3295	\$3295	\$3295
280/60	80 MB 28-meg. i.a.	\$3795	\$3795	\$3795	\$3795
	110 MB 28-meg. i.a.	\$4795	\$4795	\$4795	\$4795
	130 MB 28-meg. i.a. P80H	\$4595	\$4595	\$4595	\$4595
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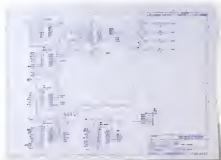
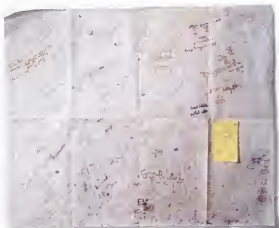
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Ted Standish, Director of Information Resources, North Atlantic Shaving Group of The Gillette Company

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Letters

FOR SOME THE VIEW FROM THEIR WINDOWS IS GREAT

Jim Seymour has punched up our number. He's looking for major users who have settled on Microsoft Windows as their mainline operating environment and Windows applications as their mainline applications ("The Windows Test," *PC Magazine*, May 30, 1989). Manufacturers Hanover does that now and has been doing that for nearly 2 years. When we began our account officer workstation project at the end of 1986, we decided to look forward, not backward. We chose 386-based platforms completely interconnected through local area networks, and running Windows/386—not even announced at the time.

Why did we make that decision? Several important reasons, some of which contradict Seymour's assertions. The most immediate benefit is the consistency of user interface that enables our users to get up the application and concentrate their questions and attention on the business aspects of the new automated environment. When Seymour says that users "neither need nor want graphical interfaces" because they like the zip of the Best Seller Spreadsheet or National Brand Word Processor, he misses a basic point. Users resent having to change mental gears in moving from one application to another. What good is "it" when you're suddenly in a database manager? Under Windows, Alt-F-O or its mouse equivalent opens a file for you, no matter what application you're running.

Windows also gives us choices. If I'm designing a major report in *PageMaker* and I want to include a variety of illustrations and charts, I can use *Microsoft Paint*, or *Micrografx Designer* or *Graph*, or *Arts & Letters*, or *Pro3D*. And I may need all of them, since their functional capabilities don't completely overlap. Plus, I have even more choices for handling scanned images. Our users appreciate the fact that they don't have to settle for the choices of a single application.



Is Windows the successor to DOS?

But in the long run, an even more important benefit we expect from sticking to the Windows suite of applications is that they are natural allies to one another. We can run them as separate and discrete modules or we can start tying them together through Dynamic Data Exchange. That means that no application need have a Chinese Wall around it. Each application can pass vital data to any other application and can even summon another application to carry out tasks that were not in the original application's domain of capabilities. And we don't have to do this as a make-or-break revolution: we can let the new capabilities evolve over an extended period of time.

But I have to admit one thing. We do run one application in a straight DOS, non-Windows environment, and that application is word processing. Not because we want to, but because right now we have to. No one has an industrial-strength word processor that runs under Windows yet, but we expect that situation to change by summer. (In fact, I'm writing this short missive using a beta version of a Windows-based word processor.)

So we are the user Jim Seymour says

he cannot find. With well over 1,000 desktop machines running Windows all day and every day, we may be a little ahead of the commercial market. But we're doing things that any other commercial user could be doing, given a willingness to invest money and talent in the future of automation and business effectiveness. And I know that there are other corporate users out there just like us.

Stephen Morse
Senior Technical Officer
Manufacturers Hanover
New York, New York

Jim Seymour stated that he found Windows "operationally clumsy" and wanted to find someone who used the Windows environment exclusively on his PC ("The Windows Test").

I am one such user. I've found that by investing some time reading the Windows manuals and using some common sense, a Windows user can tailor the Windows environment to allow him ways to create his own perfect environment. A user can alter the WIN.INI file to allow an application to run when its data file is selected, as well as many other useful "tailoring" functions. By personalizing the Windows environment, it cannot help but provide a useful alternative environment for the DOS user.

Douglas Thews
Fort Worth, Texas

WHEN YOU'RE RIGHT...

In your 386 issue ("80386: The Power and the Glory," *PC Magazine*, May 30, 1989), our Tussey Computer Products Swan 386/200 is blasted in four paragraphs because of the 8MB limit of our machine. If this criticism were true, I would have no problem with it.

However, as your "386-based PCs: Summary of Features" chart on page 278 indicates, our machine has a 16MB limit. This information is also printed in our manual and our advertisements, and it was mentioned verbally to your staff. Need-

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Letters

less to say, this mistake has damaged sales and morale here at Tussey/Swan.

Peter Sattler
President
Tussey Computer Products
State College, Pennsylvania

PC Magazine regrets this error. The Swan 386/20D's capacity is indeed 16MB.

In the sidebar to his recent review of *Volkswriter* (First Looks, page 38, *PC Magazine*, May 30, 1989), Jonathan Matkin states, "It doesn't seem likely that a sophisticated package designed to run on larger systems can easily be brought down to the PC with all its power intact." Houghton Mifflin Co.'s *CorrectText Grammar Correction System* is the only software that detects and corrects grammar and usage errors by actually parsing full sentences to analyze their grammatical structure as well as identify the relationships of the words.

In fact, the high-level functionality of *CorrectText GCS* for the PC is the same as the implementation on mainframe and mini computers. Using advanced data-compression techniques, Houghton Mifflin Co. and Lifetree Software were indeed able to reduce the program's size for use on the PC.

Denise L. Widman
Marketing Manager
Houghton Mifflin Co.
Boston, Massachusetts

We at AK Systems feel your article on tape drive systems ("To Mainframe and Back: Data Transfer by Nine-Track Tape," *PC Magazine*, April 25, 1989) was not consistent with your usual levels of evaluation.

Since we were singled out critically, we feel obliged to speak up. First, there was no description of the evaluation objectives. It was unclear what differentiates the various controllers.

Second, the article had factual errors, such as claiming that our board had no mounting bracket. The photo accompanying the article clearly shows that it is included. The article also attributes start/stop operation to our drive, when it is actually a streamer.

And lastly, although the article correctly identified our board as an earlier

version of the Catamount board, no mention was made of our new menu-driven software. This makes us wonder if our software was even used. Losing is never fun, but losing unfairly is worse.

Max C. Bosetti
President
AK Systems
Chatsworth, California

WHAT'S MISSING?

In your Letters section (*PC Magazine*, May 16, 1989), Paul Buisseret's letter about Zeos International entitled "The Missing Piece" moved us to comment further.

Zeos prides itself by providing not only superior computer systems but superior support policies, guarantees, and documentation. All Zeos customers receive a full absolute-satisfaction 30-day money-back guarantee. They also receive a 1-year warranty, complete system documentation, toll-free technical support 7 days a week, and next-day replacement of any problem component.

Greg Harrick
President
Zeos International
St. Paul, Minnesota

A SOLUTION TO THE 286/386 DEBATE ...

Great magazine. Inconsistent philosophy. Having used a PC at the office, I am aware of the many advantages of a home computer. I've read *PC Magazine's* evaluation of individual computers as well as the continuing debate of the 286 vs. the 386 computer.

Articles about each of these generally support the one being evaluated. There seems to be no real consensus among your staff. After reading the introduction to your mammoth effort to evaluate virtually every 386 available ("80386: The Power and the Glory," *PC Magazine*, May 30, 1989), I suppose that if one can afford a 386 with all the desired features, then one should buy a 386 with all the desired features. If not, then I feel a 286 will still provide satisfactory results but with some limitations.

My solution? I bought a boat.
S. M. Huston
Knoxville, Tennessee

... BUT THE DEBATE GOES ON

I would like to thank you for your timely and interesting article on 80386 systems ("80386: The Power and the

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Letters

Glory"). After examining the benchmark test charts and captions, I came up with a question: If most of the operating systems of the future will be utilizing extended memory, how important are the figures in the chart? I feel that if an operating system will be using this memory, then the access times would be critical to have the overall throughput of that system.

Bobby G. Roberts
Panama City, Florida

I looked forward to seeing how my recently bought 80386 machine stacked up in your review of every 80386 ("80386: The Power and the Glory"). Unfortunately, it wasn't there. I realize that the Wells American CompuStar has been billed mostly as a 286 that can be upgraded to a 386, but I bought mine with a 386 right from the start. In addition, it came with four floppy disk drives (two 3½-inch, two 5¼-inch, in both 1.2MB and 360K), the hard disk, a full-height drive bay, and six AT expansion slots to spare—a configuration very few computers in your comparison could attain.

Craig Werner
New Britain, Connecticut

SOME MISSING TOOLS

Edward Mendelson's review of *PC Tools Deluxe*, Version 5 (First Looks, page 48, *PC Magazine*, April 11, 1989) was greatly appreciated, but there were many inaccuracies. Mendelson states, "The Norton Utilities ... includes more efficient and intuitive tools for editing and managing a disk." This is ridiculous because *PC Tools* combines almost all of Norton's functions into one fully mouse-driven program containing five very logical pull-down menus. The *Norton Utilities* consists of some 30 separate programs that must each be invoked separately or from the Norton Integrator.

Mendelson also contends that the hard disk backup program "requires too many unintuitive keystrokes ... and is fussy about the exact moment when you must insert the first disk." Again, the backup program is neatly structured into four pull-down menus. I don't see how it could be any simpler.

Kevin P. Rice
Anaheim, California



AIRMAIL E-UTILITIES

PC Magazine is a wonderful source of information. Your utilities are great, but if I want to try one of them, I have two choices:

First, I could read and type in 2,000 hexadecimal numbers.

Second, I could learn to navigate through PC MagNet, apply for a VISA card, and download at 1,200 bits per second.

The latter would be better for my eyes, but the bill would be quite high at PC MagNet's \$12.50-per-hour rate, in addition to the \$127-per-hour rate that the Belgian PTT Company charges.

Why don't you at *PC Magazine* make available a quarterly utilities diskette for its faithful but frustrated readers everywhere?

A. Leyder
Brussels, Belgium

CORRECTIONS AMPLIFICATIONS

Amax Engineering Corp., maker of the Amax PC/386-16, PC/386-20, and PC/386-25 ("80386: The Power and the Glory," *PC Magazine*, May 30, 1989), distributes its computers only through local dealers, not by mail order.

The correct telephone number for AT&T, maker of the AT&T 6386 WGS ("80386: The Power and the Glory") is (800) 247-1212.

The correct telephone number for LaserMaster Corp., maker of the LaserMaster LX6 Professional Controller (First Looks, page 46, *PC Magazine*, May 16, 1989), is (612) 944-6069.

The telephone number for Sundog Software Corp., maker of *Squish Plus* (First Looks, page 48, *PC Magazine*, June 27, 1989), is (718) 855-9141.

HOW TO WRITE TO PC MAGAZINE

Send letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). All letters become the property of *PC Magazine* and are subject to editing.

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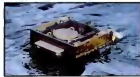
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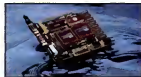


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CIRCLE 192 ON READER SERVICE CARD

Advisor

EMS ON AN AT

I am interested in software that would allow me to configure my AT's extended memory to LIM EMS 4.0. Are there any packages that can do this?

Jeff Hall
Pakenham, Ontario
Canada



Abandon all hope, ye who enter here: if Dante were alive today, he'd probably dedicate a circle of Hell to the lost souls attempting to emulate expanded memory on 80286-based machines. Not that it can't be done or that there aren't plenty of products that try, but configuring a software emulator to work with your favorite programs can seem like an impossible task.

For instance, programs such as *Javelin*, which employs a seldom-used technique called *page aliasing*, aren't compatible with EMS emulators; *page aliasing*—mapping one page onto multiple pages of the page frame—requires an expanded memory board.

The two most flexible emulators on the market are *Above DISC*, Version 3.0 (\$99.95; Above Software, 3 Hutton Centre, #950, Santa Ana, CA 92707; (714) 545-1181) and *Turbo EMS*, Version 4.2 (\$99.95; Lantana Technology Inc., 4393 Viewridge Ave, Suite A, San Diego, CA 92123; (619) 565-6400).

Both programs offer menu-driven installation and configuration; they also accommodate certain programming eccentricities, such as *Microsoft Windows'* need for page-frame allocation at the highest available memory address and *Paradox's* demand that the frames be located on a 16K boundary. In addition, you can specify the initial memory segment. These emulators will also allow you to simulate expanded memory using your hard disk—something that only people with very little money and lots of time on their hands would want to do.

Other capabilities that make these packages attractive include the ability to

- **EMS ON AN AT:**
Simulating LIM EMS 4.0 expanded memory on an AT compatible.
- **OPTIMIZING YOUR HARD DISK'S INTERLEAVE:**
Speeding up your hard disk to keep pace with your system.
- **DON'T INTERRUPT ME:**
Locating interrupt conflicts when installing hardware.

free the allocated memory without re-booting (under the proper conditions) and the capability to hide it from an application. Hiding memory is useful, for instance, because applications that automatically use available EMS memory whether they need it or not might run faster without it.

Power users as well as neophytes will appreciate the accompanying manuals, which offer good explanations of expanded memory and its emulation. (For more information, see Douglas Boling's EMS40 utility, described in the Utilities column in the June 27, 1989, issue of *PC Magazine*.)

Of course, these programs also have capabilities that distinguish them from each other. *Turbo EMS*, which takes up about 68K of conventional memory, includes a *spillover* feature: if you have several types of memory (such as expanded and extended or extended and disk-based) and you run out of one type, the software will fall back on another. You can also create application-specific configuration files with *Turbo EMS*.

Above DISC, on the other hand, allows users with 80286 chips dated later than August 1987 to allocate the page frames entirely outside of conventional

memory, shrinking overhead from 78K to only 1K. The penalty is a slowdown in performance.

Speaking of speed, if you're an intensive user of *Windows* or *DESQview*, you might want to spring for an expanded memory board. Emulation is slow enough as it is; when performing the large amount of swapping required, some applications slow down unbearably.

OPTIMIZING YOUR HARD DISK'S INTERLEAVE

I use a turbocharged IBM PC in which I've replaced my hard disk controller. I believe I could coax better performance from my hard disk now that I have the accelerator card if I could reduce the interleave from 6:1 to maybe 2:1. How can I change my hard disk's interleave?

Eric Otterbacher
Midland, Michigan



Changing your disk's interleave requires performing a low-level format, which normally destroys your data. If you've already backed up your hard disk, don't want to buy yet another disk utility, and feel comfortable using DOS's DEBUG program, then all you need to do is enter G=C800:5 at DEBUG's prompt. This should call up the disk utility program in ROM. (If not, try C800:6 or C800:8—location varies with different systems.)

On the other hand, a couple of programs will let you change your interleave without wiping out your data: *Spin-Rite* (\$59; Gibson Research Corp., 22991 La Cadena, Laguna Hills, CA 92653; (714) 830-2200) and *OPTune* (\$99.95; Gazelle Systems, 42 N. University Ave., #10, Provo, UT 84601; (800) 233-0383 or (801) 377-1288). A First Look at *Spin-Rite* appears in the October 11, 1988, issue of *PC Magazine*; *OPTune* was reviewed in the February 14, 1989, issue.

Both of these utilities determine the optimal interleave, perform a nondestructive low-level format, and change

Advisor

the interleave of your disk. Neither program will low-level-format an RLL-encoded disk. Although *SpinRite* offers more in-depth doctoring for your hardware, *OPTune* can handle partitions larger than 32MB.

Before buying either of these products, call the company to ensure that the program is compatible with your controller. Also, unless you're a risk-seeking individual, you'd be wise to back up your hard disk before moving a single byte.

DON'T INTERRUPT ME

Occasionally, when installing a new add-in board, I am unable to determine the interrupts set for other boards already in the PC. Determining which interrupt to use for the new board can become a time-consuming trial-and-error experience. Is it possible to write a software routine that can automatically determine which interrupts are already in use? Are there any such routines available?

David Harding
Lanham, Maryland



Touchstone Software's computer cavalry rides to your rescue in the form of *CheckIt*, a \$149 PC diagnostic utility (909 Electric Ave., Seal Beach, CA 90740; (800) 531-0450, (213) 598-7746 in California).

Once you tell
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An easy-to-use, menu-driven program, *CheckIt* will tell you the IRQ assignments of your currently loaded devices as well as the standard DMA assignments native to the system; unfortunately, it won't tell you the DMA channels used by add-in boards. You can print out reports of the configuration of your system for future reference.

In addition, *CheckIt* runs diagnostics on your motherboard, memory, drives, video subsystem, communications ports, and peripherals, such as the printer, mouse, and keyboard. Once you tell the program the configuration of your memory, *CheckIt* will also show you a map of your RAM chips and display the location of any bad ones and if you're wondering how powerful your system is, *CheckIt* can run various benchmark tests to gauge your machine's performance.

ASK THE ADVISOR

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CIRCLE 231 ON READER SERVICE CARD



"They Laughed When I Said I Actually Enjoy Doing My Finances"

You know how it is when you find something you really like. You tell all your friends about it. That's what I did after I discovered Quicken.

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Hey - I'm not a millionaire or a tycoon. My finances aren't the most complicated in the world. Even so, they took too much time. Plus, I didn't always have the information I needed for taxes, budgeting, and keeping better track of my cash flow.

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An Incredible Time Saver

It's amazing - I now enjoy a chore I used to dread. You see, Quicken does all the tedious, time-consuming work for me. I finish in minutes what used to take hours! Quicken actually learns my regular bills. I simply confirm payment amounts each month. Then it hands me printed checks already addressed for mailing. I save at least two hours every month - that's like three extra days of vacation each year.

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EDITOR'S CHOICE
VGA Wonder
July 1989



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First Looks

Hands-on Reviews of the Latest Products

1-2-3, Release 3, Brings Three-Dimensionality, External DBMS Access, and Few Disappointments

HANDS ON
by Craig Stinson

More than a year after it was announced, *Lotus 1-2-3*, Release 3.0, has arrived with enhancements to virtually every aspect of the program. Lotus Development Corp. obviously took a long, hard look—perhaps too long—at its breadwinner, at the competition, and at all the suggestions for improvement that came in the form of Release 2 add-ins, then judiciously adopted the best of what it found. The result is an impressively powerful, feature-rich, and, for the most part, well-designed spreadsheet. The \$495 program isn't perfect, but there's a great deal to applaud.

Perhaps the best news for current 1-2-3 users is that, in terms of both compatibility and learning curve, the move up may be less painful than feared. WK1 files can be read into Release 3 without a translation step, and everything—macros included—will work normally. (Some macros may fail if they rely on cursor moves instead of first letters for command selection.) WK3 files can be exported back to Release 2 either directly (if they don't use Release 3 enhancements) or via the Translate program. So mixed Release 3/Release 2 workgroups should be feasible.

As for the learning curve, Release 3's use of three-dimensional worksheets—the most significant change in this upgrade—should strike most users

as a straightforward extension of what they already know. The commands for adding and deleting sheets, for moving and copying between sheets, for defining multisheet ranges, and for navigating in three dimensions should all be pretty straightforward if you know your way around Release 2. Some other aspects of the program may send you to the manual, but you shouldn't need to take a seminar to become pro-

mended) for OS/2. Lotus stipulates that the 1MB under DOS must consist of 640K conventional plus 384K extended memory.

If all your memory above 640K comes by way of an expanded memory card, you'll bear the burden of reconfiguring the chips to be extended, which will inconvenience anyone who has already gone to the trouble of painstakingly configuring his memory board to run larger

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The multisheet capability of 1-2-3, Release 3, simplifies consolidation models. Perspective view, shown here, lets you see three layers of the model at once.

ductive with Release 3.

What you will need is an 80286- or 80386-based PC and a lot of memory. Release 3 runs under DOS (3.0 or later) or OS/2 (1.0 or 1.1); it requires at least a megabyte for the DOS version or 3MB (4MB recom-

mended) for OS/2. Lotus stipulates that the 1MB under DOS must consist of 640K conventional plus 384K extended memory (LIM 3.2 or 4.0), but

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Presentation-quality charting for serious users of data 48

you'll get the best performance by configuring as much memory as possible to be extended.

Three-dimensionality is the dominant new feature in Release 3. A Release 3 file starts out as a normal grid (or "sheet") of rows and columns, but you can add as many as 255 additional sheets. Each is identified by a letter in the upper-left corner, and every cell in the workspace is identified by three coordinates—the sheet letter, the column letter, and the row

CONTINUES ON PAGE 34

First Looks

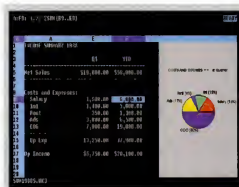
Lotus 1-2-3

CONTINUED FROM PAGE 33

number. A Perspective command, which is all but buried in the command sequence, lets you see three sheets at once on-screen, and a Group mode command enables you to format all sheets of a file identically.

Multisheet files are good for many things, the most obvious of which are the segregation of functional worksheet areas onto separate pages and the easing of consolidation chores. With Release 3, you shouldn't ever have to worry about clobbering a macro by deleting data records, and you won't have to work in the dark when rolling up subsidiary data into a consolidation.

Release 3 also offers the other kind of three-dimensionality, popularized by Microsoft's *Excel*—the ability to write a formula in one file that references a cell or range in another file. This "file-linking" feature allows you to centralize data for reuse in multiple contexts. It also gives you a way to build models larger than available memory. Although Release 3 lets you keep as many files open in memory as your system permits, it doesn't require the target file of an external reference to be in memory; you can link an



If you have a graphics display, 1-2-3, Release 3, lets you keep the current graph visible while you work with the numbers.

active file to a disk file and use the Link-Refresh command to keep the calling formula current.

Beyond three-dimensionality, the most important enhancements in Release 3 fall under the database wing. A new /Data External command allows you to access records in third-party DBMS files. You simply assign a range name to the external table, then supply that range name to the /Data Query Input command (or use it as input argument for the database statistical functions). Thereafter, the external "range" behaves as

though it were an ordinary 1-2-3 data table.

To use this outreach capability, you need a driver specific to your external DBMS, and to date the only such item available is a sample *dBASE III* driver included by Lotus. But it's a safe bet that third-party drivers for major DBMSs will be available by the end of the year.

Other database improvements include simpler criteria formulation, the ability to perform relational operations on two or more data tables, the ability to include formulas in an output range, a /Data Query

Modify command that lets you make changes to an input range (particularly useful if the input range is not in the current file), a couple of handy new macro commands for appending fields and records to tables, and a (FORM) macro command for automating data entry. (FORM) represents a huge increase in control and flexibility over Release 2's /Range Input command.

In the graphing department, Release 3 offers some new graph types (including High-Low-Close-Open), the ability to create "overlay" graphs (a line graph over a bar graph, for example), the ability to set up two y-axes, a logarithmic scaling option, more text options, and better control of colors and patterns. If you have a graphics screen, you can now open a graph window and keep the current chart visible as you work. And PrintGraph is gone; you can now print graphs from within 1-2-3. (Unfortunately, you can't print them side by side with tabular matter. To get a graph and a worksheet on the same page, you have to queue them up as consecutive print jobs, and one will appear directly above the other.)

Despite these improvements, 1-2-3 is still nothing like a presentation-quality charting machine (which *Excel* arguably is, at least for some users). But then Lotus is betting that you'll use its other products for that purpose. To facilitate transfer to presentation-quality programs, Release 3 lets you store graphs in .CGM and .PIC formats.

Printing in Release 3 takes place in the background, allowing you to continue working while your printer churns. New queue-management commands let you suspend printing, resume after an error, move particular jobs to higher or lower priority, and cancel the queue. Other new commands let you assign printing attributes (font, style, size, color, orientation) from menus and name a given constellation of print settings for later reuse.

Unfortunately, there is no straightforward way to create a worksheet-independent library of named print settings; like a

DOS EXTENDER LETS 1-2-3 ACCESS MEMORY BEYOND 640K

by Craig Stinson

1-2-3, Release 3, is the latest in a growing number of DOS programs that run in protected mode and access memory way beyond the 640K boundary. What makes this magic possible is a tool called a DOS extender. The one used by 1-2-3 is *DOS/16M*, from Rational Systems.

A DOS extender switches your machine into protected mode as soon as the application using it starts. Then, whenever the application calls on operating system or BIOS services (when it needs to

open a file, for example), the extender switches the system back to real mode, gets the appropriate service performed, and returns again to protected mode. Depending on the program, the mode switches may occur infrequently or many times a second.

Either way, it's all invisible to you. What you see is a program that accommodates 16MB of extended memory, just as the OS/2 version does, all within the context of your familiar 640K-bound operating system.

The 1-2-3, Release 3,

package comes with disks for both DOS and OS/2. The versions are functionally identical and use the same data files, so if and when you switch to OS/2, you won't have to retrain or convert files. Nevertheless, by choosing to incorporate a DOS extender in its DOS version, Lotus has definitely given a powerful life-extending shot in the arm to this humble operating system and provided a large segment of the PC marketplace with just the latest disincentive to switch teams and convert to OS/2.

First Looks

named graph, a named group of print settings belongs to a given file. Also unfortunately, there is no publishing capability as such in Release 3. The program offers little control over vertical spacing, and its approach to font selection is fairly crude. Lotus has promised to incorporate *Allways* into Release 3 "in the near future." In the meantime, if one of the Release 2 add-ins has you hooked on publishing, hang on to it and export your print jobs back to Release 2 for output.

Release 2 add-ins, incidentally, need to be rewritten to run under Release 3. Lotus is developing a new high-level programming language for this purpose. Due for shipment in the third quarter, the *Lotus Add-in Toolkit for Release 3*—of which the language component was formerly called LEAF—will enable developers to customize the 1-2-3 macro language as well as create new @ functions and entire add-in applications.

In the macro area, aside from the inclusion of some new keywords (including a handy item for sending a command to the operating system), the big changes are that Release 3 lets

you write an unlimited number of macros and lets you store them on any worksheet that's open in memory. Thus you can create worksheet-independent macro libraries. Release 3 also includes a keystroke recorder of rather limited utility. Cursor-move keystrokes supplied as arguments to functions are converted by the recorder to fixed addresses, so even a simple general-purpose macro to add a column of numbers has to be edited after being recorded.

Other enhancements in Release 3 include a well-designed "reservation" system for ensuring file integrity in multiuser environments, friendlier error handling (you no longer get bumped back to Ready mode af-

ter clearing an error flag), optional Undo protection, and a host of minor conveniences—far too many to enumerate. You will continue to discover modest usability improvements here and there, long after you're up and running in Release 3.

As for disappointments (aside from the absence of *Allways*), the biggest for my money are Release 3's implementation of optimal (minimal) recalculation and its lack of true auditing features.

What the Lotus manual calls optimal recalculation is really background recalculation. Unlike other programs that keep track of formula dependencies and just recalculate those cells that might be affected by a new entry or edit,

Release 3 continues to recalculate the whole workspace. The improvement over Release 2 is that you're free to continue working while it does so—even to edit cells that are being recalculated. The problems with this approach are that you don't get to see the results of your changes, and you have to put up with jerky scrolling until 1-2-3 finishes the job. With a number of complex files in memory, waiting for the red CALC light to go out can be a serious irritant. (Fortunately, background recalculation times are not nearly as long as the brute manual recalculation times shown in the PC Labs performance test results that accompany this article.)

CONTINUES ON PAGE 36



PERFORMANCE TESTS: LOTUS 1-2-3, RELEASE 3.0

If you're planning to upgrade from Lotus 1-2-3, Release 2.01, to Release 3.0, also plan to take coffee breaks during many operations. The program shares *Microsoft Excel's* sluggishness when performing disk-intensive operations and *SuperCalc's* speed disadvantage imposed by the 3-D worksheets.

Mathematical Worksheet

Recalculation reports the time taken to calculate a Lotus 1-2-3 2.01 worksheet with 1,950 mathematical functions and 494 text cells. Lower times indicate more efficient implementation of standard spreadsheet functions.

The **Loan Recalculation** test worksheet calculates the monthly payment and displays the amortization schedule for a 10-year mortgage based on any given loan principal. This test is a typical spreadsheet application.

Internal Rate of Return Recalculation tests the Net Present Value and Internal Rate of Return functions. These computation-intensive formulas indicate the efficiency of a program's calculation and Internal Rate of Return algorithms.

The **Save to Disk** test measures how long it takes the spreadsheet program to save the Mathematical Worksheet

Recalculation test file to disk, using the product's native file format.

The **Load from Disk** test measures how long it takes the spreadsheet program to read the Mathematical Worksheet Recalculation test file from disk, using the product's native file format.

Relative Times

(Lotus 1-2-3, Release 2.01 = 100)

Disk Space reports the size of the Mathematical Worksheet Recalculation file when the spreadsheet program saves it to disk in the program's native file format. A smaller number here is better, leaving room for more or bigger files on the same disk.

Performance Times

(Times given in seconds; disk space given in kilobytes)

	Mathematical Worksheet Recalculation	Loan Recalculation	Internal Rate of Return Recalculation	Save to Disk	Load from Disk	Disk Space
*SuperCalc5	152.98	5.85	6.37	3.27	7.20	40
*Lotus 1-2-3, Release 3.0	144.32	3.83	6.49	7.05	20.65	83
*Lotus 1-2-3, Release 2.01	59.83	1.52	2.43	3.75	6.02	81
*Microsoft Excel, Version 2.0	48.98	3.02	2.88	8.85	29.51	79

*This product was not reviewed, but we are reporting its test results for comparison.



FACT FILE

Lotus 1-2-3, Release 3
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (617) 557-8500
List Price: Lotus 1-2-3,

Release 3: Standard Edition, \$495 (after January 1990, \$595); Server Edition (available third quarter), \$695; Node Edition (available third quarter), \$395

Requirements: DOS 3.0 or later and 1MB RAM for DOS version; OS/2 1.0 or 1.1 and 3MB RAM (4MB recommended); approximately 3.5MB of hard disk space

In Short: A major upgrade with improvements on almost every front and a disappointment or two as well. The most significant changes are 3-D worksheets, linked files, and the ability to tap external data sources.

CIRCLE 448 ON READER SERVICE CARD

First Looks

Lotus 1-2-3

CONTINUED FROM PAGE 35

As for auditing, Release 3 lets you add comments to the ends of formulas and constants, as well as assign notes to range names. There are new commands to list such range names, file linkages, and so on. There's also a map feature that allows a panoramic overview of a sheet, distinguishing labels, constants, and formulas. But there's still no way to highlight a chain of formula dependencies within a given sheet. This is fertile area for improvement.

Finally, a nontrivial bug leapt off the screen as I was running the PC Labs performance tests. Release 3 is supposed to issue a warning prompt if you quit or use *Worksheet Erase* with unsaved work in memory. But I was able repeatedly to change certain cells to certain values, then quit directly without the warning prompt being issued. (It happened only with

particular cells and particular changes; most of the time, the fail-safe mechanism operated correctly.)

Disappointments and flaws notwithstanding, it appears that Lotus has done what it needed to

do. *1,2,3*, Release 3, is strong enough to draw substantial numbers of current users to the higher ground, and it's forward-looking enough to keep *1-2-3* on top well into the next decade. ■

IS LOTUS STILL NUMBER ONE?

by Gus Venditto

Performance aside, the question surrounding the shipment of Release 3 is, Will Lotus hold on to its dominant position?

There are clear signs that *1-2-3* will never be the powerhouse it was throughout the 1980s. In the past 2 years, some estimates say, it dropped from an 85 percent share of the spreadsheet market to roughly 65 percent (estimating sales in the PC market is a black art, not a science, so these figures are basically guesses).

Release 3 will help shore up the erosion, but there's

nothing in it that is likely to regain the lost market share. Microsoft's *Excel* is better at printing and cell manipulation. Borland's *Quattro* will still appeal to the budget-minded.

Lotus's standing in the market won't be firm until it releases *1-2-3* 2.2 (the upgrade for 8088-level PCs) in the fall. With it, Lotus will have staked out the middle ground of spreadsheet software. But it has little hope of gaining the high ground until it produces *1-2-3/G*, the Presentation Manager version that's still a long way off.

store the original worksheet, it's hard to use the analysis functions with *1-2-3*'s graphing capabilities.

Budget Express has a powerful consolidation facility for merging dissimilar worksheets. You have a range of options for combining columns and rows, the most useful of which lets you match by column or row label instead of by cell letter or number.

The program is intelligent enough to add rows that occur in one spreadsheet but not the other to the end of the appropriate categories; it also combines rows that appear in both spreadsheets. For really sticky jobs, the program's Interactive mode lets you specify exactly which rows or columns should go where.

If there's a fault with this feature, it's that you can't use it to plug numbers into existing spreadsheets. If you want to perform calculations on the results of your consolidation, you must either re-create the formulas each time you consolidate or pull the consolidated figures into a master worksheet with formulas as a named range.

Budget Express is a fine program with something to offer to anyone who does budgets. Though a version for *1-2-3*, Release 3, won't be available until next year at the earliest, you may find that *Budget Express*'s outlining capabilities let you do most of what you'd otherwise do with a 3-D spreadsheet, but with less effort. ■

Budget Express: A 1-2-3 Add-in for Outlining Budgets

HANDS ON
by Rock Miller

If you're one of the many *Lotus 1-2-3* users whose job involves budgeting, you'll find an able assistant in *Budget Express*, a Release 2 add-in from Symantec Corp. This well-thought-out \$149 kit of accessories can make the chores of building and analyzing budgets dramatically easier and quicker than using *1-2-3* alone.

Budget Express organizes your budgets by outlining them, using the rows of your spreadsheet for budget categories and their detail lines, and the columns for the budget periods. If you want a summary view of your assets or liabilities, you simply collapse the detail rows and the program totals that category automatically. If you want to see your totals for the quarter

or the year, you can collapse your columns just as easily. Unlike summary tables that you create with spreadsheet formulas, you can get the detail back at the touch of a key.

The benefits of *Budget Express* go well beyond mere outlining. Once you've typed the budget category labels, for instance, you can indent the rows all at once. To create columns for your fiscal periods, you need only type in the beginning period; the program generates labels for the following periods automatically. Other functions let you create category and period totals or move categories in a single operation.

Once you've built your budget, *Budget Express* offers many tools to help you analyze it. The most notable is its goal-tracking feature, which lets you specify a goal, either as a target

amount or as a percentage or dollar change, for the cell that contains the total budget. You can then go through the budget and change various components while monitoring your progress on-screen. If you decide that you've gone down the wrong path, you can easily restore the original worksheet.

Budget Express offers a bagful of other analysis tools that let you calculate actual and percentage differences, running totals, or percent-of-total figures for any part of your budget. Unfortunately, the complexity of the various options can be daunting, and you can easily get unexpected results.

This is especially true of the Group option, whose rules require five pages of explanation in the manual. Also, since any named graphs you've created get wiped out as soon as you re-



FACT FILE

Budget Express
Symantec Corp., 10201 Torre
Ave., Cupertino, CA 95014;
(408) 253-9600.

List Price: \$149

Requires: 64K RAM free after
loading *Lotus 1-2-3*, Release
2.01, with its add-in manager,
or Release 2.2; DOS 2.0 or
later.

In Short: This outlining and tool
kit for budgeting with *1-2-3*
abounds in innovative design
touches. Its powerful goal-
tracking and consolidation
features are particularly useful.

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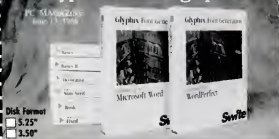
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First Looks

SmartWarell: Integrated Software with Advanced Macro Programming

HANDS ON
by Edward Mendelson

If you don't look behind the façade of *SmartWarell*, you'll see an impressive (though sometimes quirky) package that is composed of a word processor, spreadsheet, database, and communications module. But Informix's enormous \$699 program (with seven manuals) offers far more than it appears to on the surface. Its four modules are linked by an advanced programming and macro language that lets anyone with a few hours of programming experience convert the package into a system that automates all forms of corporate data handling.

Using an elaborate system that starts with custom menus and branches out into dense thickets of formulas, conditionals, variables, and arrays, *SmartWarell* allows you to write a program that prompts unskilled users to enter data that, after passing through a spreadsheet and database, determines the content of mail-merged letters and the content and destination of files sent electronically to other locations.

Much of *SmartWare*'s programming amounts to simply entering the keystrokes that you want the program to play back and then editing and combining macro files; the package also lets you create links to external C programs. Of course, if you merely want to use the macro function to record the closing of a letter and play it back later, *SmartWarell* won't force you to do anything fancier than that.

SmartWare's printer and monitor support is better than just about any other integrated package's and often surpasses that of advanced standalone programs. Color printing is available for text and graphics, and hundreds of special charac-

ters are supported. *SmartWare* can drive PostScript printers by using their built-in fonts. With many printers, the program can create its own reasonably good graphics-based fonts in Greek, script, and other styles, although it doesn't support standard soft fonts. Graphics displays of up to 800 by 600 dots per inch and text displays of up to 60 lines by 100 columns, or 45 by 132, are available for most standard video cards and monitors and are selectable from a menu.

SmartWare's modules can import and export files to each

other. The database module, always the pride of the *SmartWare* package and a worthy rival to expensive standalones, has now shed almost all of the limitations of earlier versions. Up to 127 files can be combined or linked, and 120 files can be combined into one report. Creating and modifying databases is a matter of a few menu-driven steps. Almost every detail is customizable, including the input sequence and input masks that can require numeric entries or exclude individual letters. The query editor uses a screen that looks like the display that users will eventually face, making programming a snap.

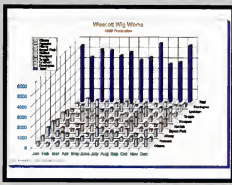
The spreadsheet module claims to let you work with sheets with 10 million cells, but you'll be more interested in background and minimal recalculation, linked worksheets, the ability to open up to 50 work-

further than the competition by letting you open as many as 50 windows simultaneously for editing different files or different parts of the same file. You can automatically view footnotes in a footnote window, but the program is surprisingly primitive in not providing word wrap in footnote text.

The communications module uses the package's standard macro language for its script files and is fully integrated with the other modules.

SmartWarell's interface uses a combination of moving-bar menus supplemented by other control keys that are displayed by cycling through a series of lists. The one unsettling aspect of using the moving-bar menus is that they let you make a choice by pressing the first letter of the item or by using the Spacebar to move around the menu. You can't use the Arrow keys to move to menu choices, an inconvenience that can be annoying if you're accustomed to using programs whose moving-bar menus work differently.

All in all, *SmartWarell* is probably the strongest of all integrated packages for the PC, with an especially powerful database. For most corporate purposes, the few advanced features available in standalone packages may be less valuable than the shared interface and integrated programming language in this program. ■



SmartWarell's extensive graphics capabilities include 3-D graphs with complete customization of fonts, patterns, and colors. You can also put multiple graphs on a page.

other and to any standard format used by other programs, but there are no hotlinks that automatically alter the data in a word processing file when you change that same data in a spreadsheet. Each module lets you split the screen to view multiple files at once, but you can't divide the screen between two different modules.

The modules themselves sport all of the standard conveniences and include some im-

pressive extras. The database module, always the pride of the *SmartWare* package and a worthy rival to expensive standalones, has now shed almost all of the limitations of earlier versions. Up to 127 files can be combined or linked, and 120 files can be combined into one report. Creating and modifying databases is a matter of a few menu-driven steps. Almost every detail is customizable, including the input sequence and input masks that can require numeric entries or exclude individual letters. The query editor uses a screen that looks like the display that users will eventually face, making programming a snap.

The word processor sports a spelling checker and thesaurus, creates indexes and tables of contents, handles variable-width columns, and offers other familiar features. But it goes



FACT FILE

SmartWarell

Informix, 16011 College Blvd.,
Lenexa, KS 66219; (913) 599-
7100

List Price: \$699; database
alone, \$349; spreadsheet
alone, \$249; upgrade from
earlier version, \$199; nodes for
LANs, \$249 each

Requires: 512K RAM (640K
RAM recommended), hard
disk, DOS 2.0 or later (DOS 3.1
for LANs)

In Short: An extremely flexible
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Garry Ray, writing for PC Week said, "Of these three alternative operating environments (OS/2, Desqview and Software Carousel), Carousel may be the best choice of the day."

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20MB/65ms	\$1,199	\$1,499	\$1,699
40MB/40ms	\$1,379	\$1,679	\$1,879

286/16 ~~\$995~~ \$895

	Mono	EGA	VGA
40MB/28ms	\$1,549	\$1,919	\$2,069
80MB/28ms	\$1,795	\$2,165	\$2,335

286/20 \$1,095

ACMA 386/20 Professional System

- Intel 80386-20 CPU running at 16/20MHz (keyboard switchable)
- 1MB 32-bit high-speed RAM, expandable to 16MB (8MB 32-bit on system board)
- 0 wait state w/page mode interleaved arrangement
- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80387 math coprocessor
- One 32-bit (available), four 16-bit & two 8-bit expansion slots
- 200 watt UL, CSA & TUV approved power supply (110V/220V)
- ROM-based setup
- Extended BIOS functions to enable or disable shadow RAM, EMS & interleaved mode
- Choice of 1.2MB or 1.44MB floppy disk drives
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel & serial ports
- Enhanced 101-key keyboard
- ACMA 386 utility software

\$1,595

	Mono	EGA	VGA
40MB/28ms	\$2,149	\$2,519	\$2,689
80MB/28ms	\$2,395	\$2,765	\$2,935

ACMA 386/25 Business System

- Intel 80386-25 CPU running at 16/25MHz (keyboard switchable)
- 1MB 32-bit high-speed RAM, expandable to 16MB (8MB 32-bit on system board)
- 0 wait state w/page mode interleaved arrangement
- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80387 math coprocessor
- One 32-bit (available), four 16-bit & two 8-bit expansion slots
- 200 watt UL, CSA & TUV approved power supply (110V/220V)
- ROM-based setup
- Extended BIOS functions to enable or disable shadow RAM, EMS & interleaved mode
- Choice of 1.2MB or 1.44MB floppy disk drives
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel & serial ports
- Enhanced 101-key keyboard
- ACMA 386 utility software

\$1,895

	Mono	EGA	VGA
40MB/28ms	\$2,449	\$2,819	\$2,989
80MB/28ms	\$2,695	\$3,065	\$3,235

ACMA Workstation Basic Diskless Workstation

- Intel 80286-12 CPU running at 6/12MHz
- 640K RAM (on system board)
- Remote boot PROM
- Parallel & serial ports
- Upgradeable to a full function PC
- Two 3.5" half-height drive slots
- Low profile case w/power supply
- Two 16-bit & three 8-bit slots
- Enhanced 101-key keyboard
- Supports 80287 math coprocessor

\$675

Ethernet Workstation

- Novell NE-1000 or NE-2000 compatible (8-bit or 16-bit)
- Memory on networking card: 8K (8-bit card), or 16K (16-bit card)
- 10 Mbps data transfer rate, baseband
- IEEE 802.3 Industry Standard

8-bit \$975

16-bit \$1,025

ARCnet Workstation

- SMC ARCnet compatible
- 2.5 data transfer rate
- Memory on networking card: 2K
- Star or Bus Topology

Star \$865

Bus \$995

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Complete Back-to-School Package

Includes **FREE** Surge Protector and Printer Stand

ACMA's 10MHz Turbo - 640K RAM - 360K floppy drive and controller - parallel port - 8087 math coprocessor support - eight expansion slots - 84-key keyboard - monochrome monitor with tilt/swivel stand - Epson LX-810 printer (200/30 cps) - 6" parallel printer cable - ten diskettes - computer paper. Upgrade with EGA or VGA displays, and/or 20MB or 40MB hard drives.

"Back-to-School" Special \$839

Complete Business Package

Includes **FREE** Surge Protector and Printer Stand

ACMA's 286/12MHz - 20MB hard drive - 0 wait state - page mode interleaving - shadow RAM for BIOS relocation - EMS/LIM 4.0 support - dual hard/floppy controller - 512K RAM expandable to 8MB on the system board - five 16-bit and three 8-bit expansion slots - 200watt UL approved power supply - either a 1.2MB or 1.44MB floppy drive - 80287 math coprocessor support - parallel and serial ports - ROM based setup-enhanced 101-key keyboard - monochrome monitor with tilt/swivel stand - Panasonic 1191 printer (240/48 cps) - 6" parallel printer cable - ACMA 286 utilities - ten diskettes - computer paper. Upgrade with EGA or VGA displays and/or larger hard drives.

"Business" Special \$1,295

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NEC:	
Multisync - 3D	\$595
Multisync - 2A	\$475
Multisync Plus	Call
Hyundai -- Special! --	
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14" EGA, 31 Dot Pitch	\$295
14" VGA, 31 Dot Pitch	\$299
14" VGA, 41 Dot Pitch	\$279
Samsung:	
12" Monochrome	\$75
14" Color	\$215
14" EGA	\$325
14" VGA	\$365
14" Sync Master	\$425
15" Full Page	\$385

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Epson:	
LX810, 180/30 cps	\$185
FX1050, 330/88 cps	\$339
LQ210, 180/60 cps	\$339
LQ850, 330/88 cps	\$519
LQ1050, 330/88 cps	Call
LQ2550, 400/108 cps	Call
Panasonic:	
1180, 192/38 cps	\$185
1191, 240/48 cps	\$245
1124, 192/63 cps	\$329
1592, 220/38 cps	Call
1595, 290/51 cps	Call
1524, 240/80 cps	Call
4450	Call

Video Cards

ATE:	
VGA	\$219
VGA Wonder	\$319
Orchid:	
VGA	\$269
Pro-Designer VGA	\$299
Pro-Designer VGA+	\$399
Paradise:	
VGA	\$249
VGA+ 16	\$299
VGA Professional	\$469
Video 7:	
VEGA VGA	\$259
Fast Write VGA	\$339
VRAM VGA	\$479
ACMA:	
16-bit VGA	\$169
EGA	\$129
Mono/Graphic	\$39
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CIRCLE 405 ON READER SERVICE CARD

First Looks

Superbase 2: An Entry-Level DBMS For Windows

HANDS ON
by Richard Hale Shaw

Microsoft Windows users who don't want to leave that graphical environment to browse through, select, or report on dBASE files can look to Superbase 2 from Precision Software for help. Used either with dBASE or by itself, the \$295 nonprogrammable database management system offers multiple, relational capabilities and lets you attach graphical images to individual database records.

Superbase 2 takes full advantage of Windows' graphical

user interface to let you use pull-down menus, dialog boxes, and, of course, windows to view and manipulate a database. The program makes terrific use of the mouse, which means you'll need only the keyboard to edit database records or to fill in query search values. With the help of dialog boxes, you can even use Superbase's mouse-based interface to create filters and queries.

But the impact that a GUI can have on a database comes through even more clearly in Superbase's implementation of VCR-like browsing controls. With a mouse click, you can use these VCR-like buttons to skip swiftly from record to record or to scan the database from front to back or vice versa (like fast-forward and rewind). The buttons will help you find or filter out records or jump to either end of the database. Pause and stop buttons let you control operations in progress.

Superbase 2 includes a full-screen text editor, which can



Superbase 2 displays database records and associated text and graphics, as well as on-line help, simultaneously.

edit both formatted files and text files. The editor sports such word processing features as word-wrap, search-and-replace, and block operations. You can use the editor to create form letters and mail-merge them with database records; you also can copy, cut, and paste the letters via the Windows Clipboard.

Unlike DBMSs that offer memo fields and weak editing facilities, Superbase 2 lets you attach a text file to a record. You create a field that contains a text file's name and the program will display the file with the built-in editor. You can even search the text file entries for a specific word or phrase.

Similarly, Superbase 2 lets you attach graphics files (including PCX, TIF, or IMG formats) to database records, and it will display the graphics in a window. Thus, a personnel database could have a picture of each employee attached to a database record and displayed along with it.

Superbase 2 also lets you control data validation with multiple-response, required, and read-only fields. It can automatically recalculate formula-based numeric fields, and there is no limit to the number of fields per record or the size of a record in a database. The program can import and export multiple file formats, including delimited ASCII, dBASE, Lotus 1-2-3, Microsoft Excel, and .DIF. It can read and display dBASE files, but you can't edit them until you import them into a Superbase 2 database. The program will also be compatible with and upgradable to Superbase 4, Precision Software's

forthcoming DBMS, which will include a graphical forms editor and a database programming language.

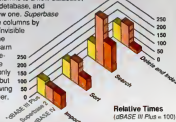
The Superbase 2 query facility has a user-friendly front end that masks the complexities of building queries. You can control which fields are displayed, how they're formatted, the record selection criteria, and the record order. Queries can be named, saved, and reused, and you can use them to access more than one file at a time or to perform global database updates. There are 54 functions available for manipulating and formatting data. You can use the functions in formulas, filters, and queries and for controlling global updates.

As if this weren't enough, Superbase 2 includes a runtime version of Windows and a communications module for transferring files to remote systems. Although the communications component is rather crude and doubtless won't replace your favorite Windows communications program, it's nevertheless handy to have.

BENCHMARK TESTS: SUPERBASE 2



The Delete and Index test times for Superbase 2 appear to be much slower than those of dBASE IV, but this is primarily a result of the test's algorithm, which requires that deleted fields be physically removed from the database. This might mean copying the remaining columns to a new database, deleting the old database, and renaming the new one. Superbase 2 lets you delete columns by rendering them invisible until you pack the database to reclaim the space. Therefore, deleting the columns takes only a few seconds, but physically removing them takes longer.



Performance Times (Times given in seconds)

	Import	Sort	Search	Delete and Index
dBASE III Plus	352.00	134.00	8.00	166.00
Superbase 2	303.24	181.91	23.46	224.21
dBASE IV	298.00	92.00	13.00	36.00

* This product was not reviewed, but we are reporting its test results for comparison.

The **Import** test measures how quickly the database can import an ASCII file (of either fixed field length or comma-delimited format) with an index on the first field. We include the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs require a two-step process for this test: an import followed by indexing.

The **Sort** test measures the time it takes

for the package to sort the files on an unindexed field in ascending order.

The **Search** test measures the time it takes to locate the first record that satisfies two criteria (make < Fandhi and model < coupe).

The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and Transfers) from a Product table created for this test, and then to render the file if necessary.



FACT FILE

Superbase 2
Precision Software, 8404
Sterling St., Suite A, Irving, TX
75063; (214) 929-4888.
List Price: \$295
Requires: 640K RAM, hard
disk, Microsoft Windows-
compatible graphics adapter,
DOS 3.0 or later.
In Short: A Windows-based
multiple DBMS for
nonprogrammers that is very
easy to use.

CIRCLE 441 ON READER SERVICE CARD

First Looks

IBM's DisplayWrite 5/2 Composer for OS/2 Brings Low-End DTP to High-End Computers

HANDS ON
by Edward Mendelson

After a decade or two of life in workstations, mainframes, and PCs as a character-mode caterpillar, IBM Corp.'s *DisplayWrite* has suddenly taken wing as a graphics-mode butterfly. Now called *DisplayWrite 5/2 Composer*, the \$695 word processor requires OS/2 1.1 but isn't a Presentation Manager program. It does bring the first true WYSIWYG text processing to OS/2, however, and uses the memory resources of that operating system to offer functions that aren't available to comparable DOS programs.

DisplayWrite 5/2 Composer is composed of two separate programs. The first, and less interesting, of the pair is *DisplayWrite 5/2*—essentially the same character-mode clunker familiar from earlier versions. The program looks and works much like the new \$495 Version 2.0 of DOS-based *DisplayWrite* 4. The interesting part of the

package is the new graphics-based *Composer Extension*, which looks and acts like a desktop publishing package but has a keyboard interface more or less similar to that of *DisplayWrite 5/2*. The two parts of the program can read the same files, although in some circumstances you have to make the files jump through some import-export conversion hoops first. Amazingly, neither program conforms to the SAA standard.

Unlike *DisplayWrite 5/2*, *Composer Extension* was written not by IBM, but by a company called Beyond Words. The two programs have some surprising differences. You can use a mouse in character-based *DisplayWrite 5/2*, but you can't in graphics-based *Composer*, where you really need it. To move *Composer*'s cursor in large jumps, you use Ctrl-Arrow key combinations, while for small increments you use the Shift-Arrow combinations. Ordinary letter-by-letter movement requires only the Arrow

keys. *DisplayWrite 5/2* uses a case-sensitive text-search function, while *Composer*, which is too slow for text editing, has all the search options you could desire.

The character-based part of *DisplayWrite 5/2* now approaches the level of flexibility that *WordPerfect* and *Microsoft Word* achieved around 1984. You can now edit two files at once, sort blocks of data, convert a block from lowercase to uppercase, and have columns with variable widths. You can use proportional type, even with non-IBM printers, although you have to identify the typeface by number. One advanced function of *DisplayWrite 5/2* is its new graphics preview with multiple zoom levels; another is its ability to read .WK1 and dBASE III files directly.

The graphics-based *Composer Extension* is a lot more flexible, although not much faster. It gives you easy-to-use DTP functions and comes with 50 well-designed stylesheets. You switch from text-entry mode to layout mode with a single key, and the stylesheet menu shows you the appearance of each type style. The picture-selection menu displays miniature versions of each image. Thirty images in *Composer*'s own format come with the package, and you can also import TIFF files or scan in your own images using an IBM scanner.

A clever manual kerning function lets you use the Arrow keys to move characters either horizontally or, for equations and dropped capitals, vertically. Automatic kerning is available, and, for any text style, you can specify minimum and maximum levels of "tracking" (word and letter spacing) and choose one of five preset levels in between. You can flow text around rectangular graphics, but not around irregular shapes. Layout controls are generally less exact and extensive than those offered by *Pagemaker* or *Ventura Publisher*.

OS/2 gives *Composer* enough elbowroom to display two documents on the same screen, and the built-in macros and general ease of use make this an attractive program—un-



DisplayWrite 5/2 Composer

IBM Corp.

Available from IBM dealers

List Price: \$695

Requires: 20MB on a hard

disk, EGA or VGA monitor,

OS/2 1.1.

In Short: An awkward character-based word processor combined with an easy-to-use desktop publishing package. The word processor has full printing functions; the DTP component uses embarrassingly crude fonts.

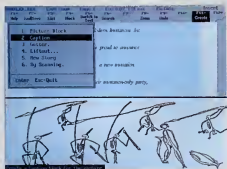
CIRCLE 444 ON READER SERVICE CARD

til you print a file. Unless you use a PostScript printer's Times or Helvetica, *Composer* uses none of the printer's native fonts. Instead, it can use only its own crude "graphics" fonts—startlingly coarse bit-map images that the program combines with graphics images when composing a page.

To add injury to insult, the fonts aren't scalable at print time. If you want to use more than the small set of sizes generated for your printer during installation, you have to use a separate utility to produce each size that you need and then store it on-disk. The package comes with *Compugraphic's* CG Times and CG Triumverate typeface outlines.

Composer, unlike *DisplayWrite 5/2*, lets you print the document you're editing on-screen, but its poor error handling may make you wish it didn't. If for some reason your printer isn't connected, *Composer* only lets you back out of the error condition by closing the program abruptly and losing all the work you put into the document during the session.

If you work in an office that has switched to OS/2 and buys only products with an IBM label on them, you'll end up with the new *DisplayWrite* whether you like it or not. But you'll be far better off with either *WordPerfect 5.0* or *Microsoft Word 5.0*, both of which run under OS/2 or DOS. If you want well-printed DTP under OS/2, wait for the Presentation Manager versions of *Pagemaker* or *Ventura*. ■



DisplayWrite 5/2 Composer can flow text around rectangular graphics, but not around irregular shapes.

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—John C. Dvorak, *Industry Columnist*

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First Looks

Project Scheduler 4: Finally, an Easy-to-Use Project Manager

HANDS ON
by Henry Forsko-Weiss

Even project management programs designed for handling small projects have a reputation for being difficult to learn and cumbersome to use. Belying that reputation is Scitor Corp.'s *Project Scheduler 4*, a \$685 project management program that offers superb graphics, an easy-to-use Windows-like inter-

prompting offer enough assistance that you may never open the fine manual that accompanies the program. Mouse support makes issuing commands, selecting options, and moving through the program easy and very fast.

An excellent interface is just the beginning of what *Project Scheduler 4* offers. The program lets you manage a project of 1,200 to 1,500 tasks. Each task can have up to 500 resources, allowing the program to handle larger projects than most other programs in this price range. Support for expanded memory, which Scitor will be adding in the near future, will allow the program to manage even bigger projects.

Project Scheduler 4's project management graphs and charts are simply the best

change the amount of information in the boxes, view the diagram at five levels of magnification, stretch and pull the network to reshape the pattern, and even hide the arrows. The program also features well-designed histograms and cost curves.

Project Scheduler 4 lets you do true PERT analysis by specifying the optimistic, most likely, and pessimistic durations of jobs and weighting them on a scale of one to four. The program then calculates the expected job duration for you.

Project Scheduler 4's main work screen is divided into two parts. A large horizontal window at the top of the screen can hold either a Gantt chart or a network diagram. Below this, a smaller window can hold data-entry forms or can display a histogram; you can also close the smaller window, turning the top window into a full-screen view. This split-screen approach lets you see all of the major project information at one time. The program lets you change project views almost instantly. This speed extends to calculating the schedule and leveling the resources.

The program offers all of the amenities you'll need to schedule projects. In addition to basic job data, your projects can include WBS (work breakdown structure) codes, date dependencies, dates required, amount of delay, and the term (ASAP or ALAP). Jobs can have individual notes, multiple dependencies, and lead or lag times. You can use the WBS, OBS (organizational breakdown structure), and RBS (resource breakdown structure) codes to roll up individual jobs into summary bars on a Gantt chart or to focus reports. And you can generate a schedule that proceeds from start to finish, or vice versa.

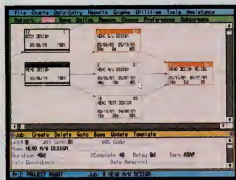
Besides using the RBS code, you can classify resources as labor, material, or other and can specify unit costs in dollars per minute, per hour, per day, and so on. But the only way to enter changing cost rates or to split availability for a resource is to reenter it, which is one of the program's weaknesses. Also, you can't record an overhead

cost for a job unless you enter it as a resource.

To track a project, the program relies on the percent complete field in the job form and the actual units and actual cost fields in the resource form. Unfortunately, there is no way to enter the actual days spent on a job, which is an important missing feature.

The program's report facilities could also stand improvement. Although you can sort and filter reports to customize the output, there is no way to save a customized format for later use. Whereas the program is strong on producing graphical reports with clear, well-designed symbols and excellent use of color, you'll have fewer textual reports from which to choose than you would if you used other similarly priced programs. To compensate somewhat for this weakness, the program exports data for use in *Lotus 1-2-3 2.0*, *dBASE III Plus*, or ASCII format, and creates special reports with those programs. But this is at best an inconvenience. *Project Scheduler 4* supports most dot matrix printers, the HP LaserJet and PostScript printers, and HP-compatible plotters and Houston Instrument plotters.

Although *Project Scheduler 4* would benefit from improved tracking and reporting features, it still has a great deal to offer. With good scheduling facilities, excellent graphics, and the best interface in its class, the program is well on its way to becoming the premier project manager.



Project Scheduler 4 splits the main work screen to show a network diagram (top window) or Gantt chart and a data-entry form.

face, and excellent on-line help—a combination that's hard to beat.

Project Scheduler 4's interface makes use of pull-down menus, windows, pop-up dialog boxes with radio buttons, and scroll bars. Since the interface is graphic and the choices are logical, it's possible to learn how to use the program simply by making your way through the menus. Context-sensitive help and three levels of automatic

around. You can adjust the time scale of Gantt charts, changing the units from hours to days, weeks, or months. In addition to the job name, you can choose to display the job number and/or the work breakdown number. You can also customize the system by turning on the baseline display, turning off the delay indicator, and changing the time interval widths.

The network diagram offers equal flexibility. You can



FACT FILE

Project Scheduler 4
Scitor Corp., 393 Vintage Park
Dr., #140, Foster City, CA
94404, (415) 570-7700.
List Price: \$685
Requires: 512K RAM, hard
disk, DOS 2.0 or later.
In Short: An easy-to-learn
project management program
with outstanding graphics, a
Windows-like interface, and
good on-line help. Could be
strengthened by better tracking
and reporting features.

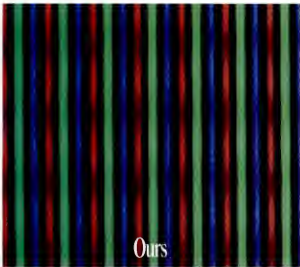
CIRCLE 448 ON READER SERVICE CARD

What A Spotless Screen Does For Windows.

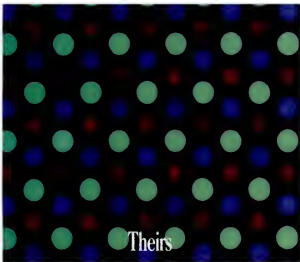
A spotless screen brightens Windows, and all your software. Measurably. That's why we use solid bars of color, instead of unconnected "spots," in our high-resolution CM-1430 monitors.

As you can see in the close-ups on the left, there's less black space between our bars than there is between their spots. 33% less, to be exact. Less black space means more electrons are hitting the screen. And more electrons make deeper colors, whiter whites, sharper lines, and cleaner type.

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Unretouched Close-Up of a NEC MultiSync® Monitor in VGA Mode.



Seiko Instruments ●

Xerox Graph Offers Presentation-Quality Charting for Scientists and Statisticians

HANDS ON
by Robin Rasikin

Following *Xerox Presents* and preceding the forthcoming *Xerox Draw*, *Xerox Graph* is Xerox Desktop Software's second program to be ported from Macintosh's classic *Cricket Presents*, *Cricket Graph*, and *Cricket Draw* line to the *Microsoft Windows* environment. Less ambitious in scope than *Xerox Presents*, the \$295 *Xerox Graph* concentrates on data-driven charting, but it also remedies most of the flaws of the earlier program while adding new power.

In the past, statisticians, scientists, and engineers would have to make do with either primitive illustrations and poor color graphs that accommodated their data well or presentation-quality graphs that couldn't handle serious data. Not any more. Along with its point-and-click user interface, *Xerox Graph* offers improved output, color handling, and fonts to serious users of data. It demonstrates that a PC program can produce presentation-quality charts without skipping on data-handling features.

In addition to pie, bar, line, scatter, area, and stacked formats, *Xerox Graph* offers such advanced charts as polar graphs and a variety of double-y-axis graphs. By making use of a clever page-layout worksheet, the program lets you create attractive overlay graphs or place multiple graphs on a page.

The program's outstanding feature is its ability to do all sorts of curve fits, regressions, and error bars. Here other presentation graphics charting packages fall flat. Not only can *Xerox Graph* handle them, but the dialog box interface makes their creation a fluid process.

You can apply curve fits to any double-y-axis, line, or scatter graph. You can choose from four types of regression curves: simple equation, polynomial, logarithmic, and exponential. The program analyzes the data and displays the equations with the curve fit. An interpolation curve fit, in which the curve passes through every data point, is also an option.

The backbone of *Xerox Graph* is an enormous 40-column by 2,700-row data sheet that can accept data imported from ASCII, .WKS, .SYLK,

.DIF, and *Cricket* formats. The data sheet is home to all sorts of computational operations. To begin, you can specify column formats just as you would with a spreadsheet, so that you can work with decimal, scientific, dollar, percent, and alphanumeric formats.

A variety of math operations—sorting, recoding, and count frequency, as well as addition, subtraction, multiplication, and division—are built into the data sheet. A smoothing function averages irregular data; a transformation feature lets you perform all sorts of statistical operations, such as running sums, z-scores, and percentages, as well as exponential, logarithmic, sine and cosine, and derivative computations. The only feature missing from the data component of the program is a data link to an external spreadsheet.

Graphing is a simple matter of highlighting relevant cells in the data sheet and selecting from among 12 graph types on a visual menu. You assign x and y data by clicking on the proper variables in a pop-up window.

Options for modifying graphs are plentiful, but it may take some time before you learn what to click on to get the results you're looking for. By clicking on any element in the graph, you can change its color, vertical and horizontal orientation, or font or point size. You can easily adjust pattern fills, explode pie slices, fine-tune tick-mark and grid-line placement, and give charts a somewhat peculiar looking 3-D effect. You can manipulate legends as separate chart elements and can adjust line styles, line widths, and markers by clicking on those elements in the chart.

A template feature lets you store and retrieve often-used customized graph styles and layouts. A palette of 256 colors is available and easy to customize. Bitstream fonts, included



FACT FILE

Xerox Graph, Version 1.0
Xerox Desktop Software, P.O.
Box 24 (125E), Rochester, NY
14692; (800) TEAM-XXR, ext.
125E; (800) 822-8221.

List Price: \$295 (\$99 for a limited time when purchased with *Xerox Presents*).

Requires: 640K RAM (1MB RAM recommended for 286-based machines, 2MB RAM for 386-based machines); hard disk; Microsoft Windows 2.1; Microsoft Windows/286; or Microsoft Windows/386; DOS 3.1 or later.

In Short: A Windows-compatible presentation graphics program that takes its data seriously. Offers a huge worksheet, plenty of built-in computation capacity, and some powerful regression and error-bar charting features, but has limited drawing tools.

CIRCLE 448 ON READER SERVICE CARD

with the program, ensure a WYSIWYG relationship between screen and output device.

A limited set of drawing tools lets you add boxes, ellipses, lines, arrows, and text. Since the program can't import .PCX, .TIFF, or .EPS symbols, you'll need to export the graphs elsewhere (through the *Windows* Clipboard or Metafile) in order to add clip art.

A text tool invokes a dialog box where you type your text and select its attributes. This is a speedy, easily editable alternative to entering text in WYSIWYG fashion. Nevertheless, *Xerox Graph* performs adequately—not admirably—with text charts. It has no facilities for creating table or bullet charts or for producing on-screen slide shows.

Xerox Graph supports a wide variety of Windows-compatible output devices but no film recorders. Instead, it offers a direct link to Autographix's slide service bureau. A special utility prepares selected chart frames as a batch file and sends them off via a built-in communications/job-order sheet.

With extensive indexed and context-sensitive help, clear error messages, and a robust set of data-handling features, *Xerox Graph* has all of the trimmings of a quality product. ■



Xerox Graph lets you choose a graph type from a visual menu, as pictured above.



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First Looks

HyperPAD Brings Hypercard-like Functionality to the PC

HANDS ON
by Rock Miller

Until recently, one thing that Macintosh owners had that PC owners couldn't get was *HyperCard*, the innovative application designer that Apple bundles with every Mac. Given the large installed base of PCs, it's not surprising that vendors have been working to bring *HyperCard* concepts to the DOS world.

First out of the gate in this race is *HyperPAD*, a \$99.95 program from Brightbill-Roberts & Co. that, like *HyperCard*, lets you create simple custom systems by pasting together elements like fields, scrolling windows, dialog boxes, and mouse-selectable "buttons." The difference is that *HyperPAD* works entirely in DOS character mode, so it's compatible with most PC setups — though you'll want at least an AT-class machine with a fast hard disk and a mouse to take full advantage of it.

If you're familiar only with conventional DOS applications, *HyperPAD*'s design will take some getting used to. Instead of files and records, you work with "pads" that are analogous to *HyperCard*'s "stacks." Each pad can have one or more pages, whose design is controlled by a "background" containing the fields and other design elements that are replicated on all pages. You can place buttons on the background or on individual pages.

To help spur your imagination, Brightbill-Roberts in-

cludes as part of the package a selection of sample desk accessories and "idea" pads with fancy visual effects, which you can mine for raw materials to use in your own pads. *HyperPAD*'s well-organized pop-up menus let you add and modify buttons, fields, and other objects and offer a nice array of drawing tools to help you dress up your pads with the IBM graphics characters.

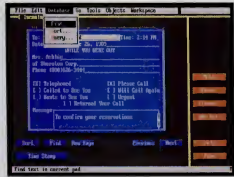
But before you rush out to your local computer store, you should pause to remember that, as a DOS character-mode program, *HyperPAD* doesn't have the advantage of the Macintosh Clipboard or MultiFinder. So you won't be able to cut and

cursor, which can make it a bit hard to predict where your typing is going to appear, or what the effects of a click-and-drag are going to be.

So, though you can create an impressive array of customized systems with it, none of them will really be as good as stand-alone programs that do the same thing. And since *HyperPAD* isn't memory resident and has no macro facility, you can't use it to tie together your work any more closely than you could with an ordinary DOS shell or menu system.

HyperPAD does let you do basic database-type queries and sorts. It has a decent reporting facility, and you can export a se-

HyperPAD does it your way; a variety of text search and database functions help you find your notes.



paste from your hypertext notes into your word processor, nor will you be able to pop up custom help pads over your spreadsheet program, as you can with *HyperCard*. And, of course, you won't have the graphics and sound that come with the Mac.

In fact, without these elements, it's hard to see what *HyperPAD* offers that existing DOS programs don't. Its text-editing and search functions are merely adequate, and its user interface action can be a bit quirky—the mouse cursor, for example, is separate from the text

lection of fields from your pad to a comma-delimited ASCII or dBASE file. But you can't write records from your pad into an existing disk file, and trying to import one will write over your pad design. And if you want to do much more than make pretty screens, you'll have to master PADTalk, *HyperPAD*'s object-oriented scripting language.

But it's precisely this aspect that is potentially the program's biggest appeal. Programming in PADTalk involves writing "handlers" that detail what a button, field, background, or



FACT FILE

HyperPAD

Brightbill-Roberts & Co. Ltd.,
120 E. Washington St., #421,
Syracuse, NY 13202; (315)
474-3400.

List Price: \$99.95

Requires: 384K RAM, two floppy disk drives or a hard disk, DOS 2.0 or later.

In Short: This object-oriented "personal application designer" offers exciting possibilities, but its character-mode design and insufficient documentation prevent it from living up to its potential.

CIRCLE 447 ON READER SERVICE CARD

other object should do when it receives a message. By reusing and modifying objects and handlers, and by making use of PADTalk's powerful functions for creating dialog boxes and responding to keystrokes and mouse input, you can build systems very rapidly. *HyperPAD*'s handy pop-up "message box" lets you test your ideas interactively by sending PADTalk messages directly to objects.

Unfortunately, *HyperPAD*'s manual is lacking when it comes to the program's more-advanced features. Once you've graduated beyond the level of patching together applications out of fields and buttons, you're left with nothing more than a basic explanation of PADTalk elements and words. Especially lacking are examples of the use of special techniques, such as layering buttons and fields. Inexcusably, there are no categorized lists of object messages or compiler error messages in the manual, and the help system is poorly organized.

As it stands today, *HyperPAD*, though intriguing in many ways, is basically a curiosity. It's a good and relatively inexpensive way to get your feet wet with the basics of a message-passing system without diving into meatier languages like the new Turbo Pascal, Version 5.5. But for something that will really bring the benefits of *HyperCard* to the PC, you'll have to wait for a *Microsoft Windows* version of the program—or for a *Windows*-based competitor. ■

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New & Improved

News of Announced Products and Upgrades

NEC Ports Lotus Applications To UltraLite.

NEW

When NEC first introduced its ultrathin UltraLite computer late last year, one of the new laptop's most exciting, and most intriguing, features was its ROM card socket, which would run applications from a plug-in cartridge no larger than a credit card.

Now, through an agreement between NEC and Lotus Development Corp., the library of UltraLite ROM cartridges has been expanded by three. *Lotus 1-2-3*, Release 2.01, and *Agenda*, Version 1.0, are available on separate ROM cards for \$495 and \$395, respectively. In addition, a single cartridge combining full-featured versions of *Metro*, Version 1.1, a PC-based desktop manager with 12 accessories, and *Lotus Express*, Version 1.0, a PC communications package for MCI mail, is also available and retails for \$235.

The chief advantage of the ROM card is its efficient use of memory. Because the software is burned into each cartridge at the factory, the applications do not need to make use of the UltraLite's RAMdisk, freeing this space for data. And because the cards plug directly into the computer, no external disk drive is necessary.

List Price: *Lotus 1-2-3* ROM card, \$495; *Agenda* ROM card, \$395; *Metro* and *Lotus Express* ROM card, \$235. **Requires:** NEC UltraLite. NEC Home Electronics (USA) Inc., 1255 Michael Dr., Wood Dale, IL 60191; (312) 860-9500.

CIRCLE 426 ON READER SERVICE CARD

ColorCapture Grabs Color Images on PS/2

NEW

In this age of high-powered multimedia presentations, there's an enormous and rapidly growing demand for videographics applications. Both educational and training videos,



ColorCapture turns any PS/2 into a desktop color video workstation.

animation, desktop presentations, and slide making all require the accessibility of high-quality color video image processing—processing that until now has been exclusively available at expensive video production facilities.

ColorCapture, a color-frame-grabber board and software kit from Data Translation, turns any PS/2 into a full-featured video workstation by providing a complete array of advanced video-capture, editing, and recording capabilities.

The frame-grabber board captures 16-bit color images from any RGB video source, such as still- or live-video cameras and re-

orders, and displays them on either an RGB or a PS/2 monitor. Furthermore, the images can be manipulated or combined with text, recorded to tape, or stored on-disk for future use. Saved in a 16- or 24-bit TIFF format file, the images can be exported at any time to page-layout software package such as *PageMaker* or *Ventura Publisher*.

In addition to the accompanying software, ColorCapture also features 768K of video RAM—more than enough memory to store one color image on-board—and a trigger cable that allows the user to time image capture to coincide with another, external event. Who says you have to go to Hollywood to make it big in pictures?

List Price: ColorCapture, \$3,495. **Requires:** IBM PS/2 MCA model, standard RGB video input device, DOS 3.3 or later. Data Translation, 100 Locke Dr., Marlboro MA 01752; (508) 481-3700.

CIRCLE 428 ON READER SERVICE CARD

HOT PROSPECT

AGILIS HANDHELD WORKSTATION OFFERS WIRELESS LAN

If James Bond ever needed a mobile, handheld, modular workstation or LAN, you can bet Q. would whip him up something not unlike the Agilis System from Agilis Corp.

The Agilis family of products gives mobile users the power and networking capabilities of a desktop workstation, packing the processing might of a 32-bit 80386-based PC into a handheld configuration.

Each Agilis workstation is composed of a series of modular components called *slices*. Latched together, they form a product ranging in size from a paperback novel to a phonebook. The slice system allows components such as battery packs, microprocessors, and storage devices to be added or removed from an Agilis unit in seconds. Thus, each machine can be instantly tailored to fit a user's specific needs.

The unit also comes with internal networking capabilities. Agilis slices communicate with each other via a built-in Ethernet bus that can be conveniently extended by using Agilis's wireless LAN. For users away from the office, the packet radio communications slice provides wireless local area networking.

List Price: \$2,000 to \$20,000, depending upon configuration. Agilis Corp., 1101 San Antonio Rd., Mountain View, CA 94043; (415) 962-9400.

CIRCLE 434 ON READER SERVICE CARD



Because of its modular design, each Agilis System workstation can be customized for a user's specific needs.

New & Improved

OCU Makes WORM Drives Look Like Winchester

NEW

WORM (write-once, read-many) optical disks allow you to store a vast amount of data on removable media. Yet until now, hooking a WORM up to a host SCSI bus invariably required modifications or additions to the operating system or the application software.

Ten X Technology's \$1,295 Optical Conversion Unit (OCU) makes using WORM drives more transparent by enabling a WORM drive to appear rewritable to the host system; thus, the WORM operates in the same fashion as ordinary magnetic disk drives using SCSI Winchester CCS-4B commands.

Although information stored on the WORM disk cannot be physically overwritten or erased, the OCU performs all of the indexing functions necessary to link new or modified data to the original, unchanged data. Data to be rewritten is identified at the block level, and only the blocks changed are remapped to the next available space while remaining linked to the unmodified data.



The Optical Conversion Unit fits into a half-height 5 1/4-inch drive bay.

List Price: Optical Conversion Unit, \$1,295.
Ten X Technology Inc., 4807 Spicewood
Springs Rd., Bldg. 3, Austin, TX 78759; (800)
922-9050.

CIRCLE 498 ON READER SERVICE CARD

Memory Master Breaks Your PC's 640K Barrier

NEW

There's no doubt about it: as application programs continue to grow and more computers have to bear the burden of large RAM-resident drivers, the DOS 640K conventional-

memory limit has become increasingly difficult, if not impossible, to live with.

Now there's a software product that gives users of RAM-hungry PC or AT compatibles a little more breathing space. *Memory Master*, from Vericom, is a set of utilities that create, recover, and conserve conventional memory.

Memory Master comes complete with four different methods, in the form of subprograms, for increasing the amount of available RAM. The combination of methods depends upon the user's hardware configuration and whether any TSRs are being used.

EDOS, the first program, provides up to 96K of additional conventional memory for use with text-based applications on machines containing EGA or VGA video systems. A special text display driver for *Lotus 1-2-3* and *Symphony* is included. Applications running while EDOS is active are limited to text modes only.

EEMRAM also supplies up to 96K RAM, but only in machines containing either EEMS boards or LIM 4.0 EMS boards that support mapping of page frames into video memory addresses. Applications can use text or Hercules or CGA graphics while EEMRAM is active.

Both EDOS and EEMRAM work by mapping EGA/VGA or EEMS/EMS memory into the normally unused address space directly

CONTINUES ON PAGE 58

IMPROVED

by Alan Cohen

Q+E, Version 2.1—New users of Microsoft Excel can acquire Pioneer Software's *Q+E*, Version 2.1, for just \$9.95 when they complete and return a coupon included in Excel packages. *Q+E* is a database query tool that links Excel to external databases and allows for dynamic data exchange (DDE) links between the spreadsheet cells and the database. The program, which works within the Microsoft Windows graphical environment, extends Excel's built-in database to any dBASE file on-disk by automatically generating SQL statements to extract data from any dBASE-compatible file. Furthermore, while the SQL statements for the query are generated automatically by a simple point-and-click process, experienced users can query dBASE files by typing SQL SELECT statements into the *Q+E* SQL Edit box or directly into Excel as a worksheet formula. Registered Excel users can obtain *Q+E*, Version 2.1, for \$49.95. *Q+E* retails for \$149. The version available from Pioneer Software contains definition commands in addition to query commands. Microsoft Corp., Redmond, Wash.; (800) 426-9400. Pioneer Software, Raleigh, N.C.; (800) 876-3101.

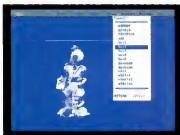
The Family Software Library—Broderbund Software has bundled three of its most popular family-oriented titles into one package, *The Family Software Library*. Included are

Bank Street Writer Plus, a word processor featuring a 60,000-word dictionary, a spelling checker, and an on-line thesaurus; *Where in Europe is Carmen Sandiego?*, a pursuit game that helps develop thinking and geography skills; and *Typeit*, a tutorial program on touch typing. *The Family Software Library* retails for \$99.95. Broderbund Software Inc., San Rafael, Calif.; (415) 492-3200.

PageBuilder, Version 2.0—CSI Publishing has revamped *PageBuilder*, Version 2.0, to include pull-down windows and a quick-start tutorial to get the user up and running. Sixteen Compugraphic fonts are also bundled with the package, and an extensive graphics editor enables users to edit AutoCAD DXF files while in *PageBuilder*. Other enhancements include word processing and line graph, bar graph, and pie chart generation features. The program also supports the Canon IX-12 scanners, allowing logos and photographs to be brought into any *PageBuilder* application. Version 2.0 retails for \$300. Registered owners of Version 1.0 can upgrade for \$50. CSI Publishing Inc., Chino Hills, Calif.; (714) 628-7873.

Lotus Ships Network Versions—Lotus Development Corp.'s leading business packages—*Lotus 1-2-3*, *Releases 2.2* and *3.0*; *Symphony*; and *Manuscript*—are now available in versions that support the major

CONTINUES ON PAGE 58



PageBuilder 2.0 features pull-down menus and the ability to import scanned images.

REPORT CARD									
Multiuser Relational Databases									
	previous rankings	Advanced Paradox 3.1	Oracle III Plus 1.1	Informix IV 1.0	Informix SQL 2.10.02	Paradox 2.0 \$125	Paradox 3.0 \$125	Microsoft Fox Plus 2.0 \$125	Team- ware 2.0 \$125
Price (base/single user)		\$950	\$895	\$125	\$195	\$405			
Performance									
Relational tests		Excellent	Poor	Poor	Very Good	Excellent	Excellent	Excellent	Very Good
Relational data entry	(85)	Excellent	Poor	Very Good	Very Good	Excellent	Excellent	Excellent	Good
Relational reporting	(75)	Excellent	Satisfactory	Good	Excellent	Excellent	Excellent	Excellent	Very Good
Relational querying	(90)	Very Good	Good	Very Good	Excellent	Very Good	Excellent	Very Good	
Programming language	(100)								
Speed tests		Satisfactory	Good	Very Good	Satisfactory	Good	Good	Good	Poor
Standard operations	(90)	Good	Poor	Good	Very Good	Good	Very Good	Satisfactory	Good
Shared user model	(75)	Very Good	Poor	Very Good	Excellent	Good	Excellent	Satisfactory*	Very Good*
Transaction model	(75)	Good	Good	Poor	Good	Very Good	Excellent	Excellent	Good
Recommendation	(75)	Poor	Poor	Satisfactory	Very Good	Excellent	Excellent	Excellent	Very Good
Ease of learning	(90)						Excellent	Excellent	Very Good
Ease of use		Poor	Satisfactory	Very Good	Satisfactory	Excellent	Excellent	Excellent	Very Good
Basic	(75)	Very Good	Unacceptable	Good	Excellent	Very Good	Excellent	Good	Excellent
Multiuser features	(90)	Very Good	Poor	Poor	Excellent	Very Good	Very Good	Very Good	Poor
Error handling	(100)								
Support		Satisfactory	Good	Good	Poor	Good	Good	Satisfactory	Excellent
Support policies	(25)	Very Good	Very Good	Satisfactory	Very Good	Excellent	Excellent	Excellent	Excellent
Technical support	(90)	Good	Unacceptable	Good	Very Good	Excellent	Excellent	Excellent	Excellent
Value	(90)					8.1	8.9	8.8	7.8
Final scores		6.8	3.8	5.4	8.3	8.1	8.9	8.8	7.8

InfoWorld, April 10, 1989

The bottom line is 8.9

InfoWorld magazine tested and compared multiuser databases. With a bottom line score of 8.9, Borland's new Paradox® 3.0 beat the well-knowns and unknowns hands down.

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The Editors Do!

Based on outstanding performance improvement provided by Multisoft's products, PC Magazine awarded an Editor's Choice in the February 14, 1989 issue.



EDITOR'S
CHOICE

• Super PC-Kwik

Speed is the only reason to use a disk cache, but speed isn't the only criterion to use in choosing one. The best cache program is the one that speeds up disk activity while occupying the least DOS memory and adapting to the special requirements of your work and your computer.

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CONTINUED FROM PAGE 54

above the 640K memory boundary. The DOS conventional-memory address space is then adjusted upward to include this new memory, resulting in a total of 736K of conventional memory. Both of these programs can be removed from the system if it becomes neces-

sary to run EGA or VGA modes.

Furthermore, a collection of utilities, called the SWAP Utilities, allows any of four popular TSRs (*SideKick*, *SideKick Plus*, *GOfer*, or *Tornado*) to be loaded into less than 9K of memory each. Finally, a program called Rollout will recover the conventional memory being used by one program, allowing a second program to load into the newly available space. When the second program is exited, Rollout will restore the first application. Rollout works with most programs that can shell to DOS (such as *WordPerfect*) by

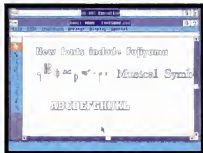
CONTINUES ON PAGE 50

IMPROVED

CONTINUED FROM PAGE 54

local area networks from Banyan Systems, IBM, Novell, and 3Com Corp. Under Lotus's new networking plan, all products will be offered in three editions: a Standard Edition, which is in fact the regular, single-user product and is priced accordingly; a Server Edition, which is designed for installation on a network server and includes the Standard Edition and special network documentation and administrative software; and a Node Edition, which authorizes the LAN administrator to add one additional license to the server. The Server Edition costs \$100 more than the Standard Edition, while the Node Edition is \$200 less than the Standard. Hence, in the case of Release 3.0 of 1-2-3, the Standard Edition retails for \$595 (\$495 until December 31, 1989), the Server Edition for \$695, and the Node Edition for \$395. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500.

Corel Draw, Version 1.1—This new release of the Microsoft Windows-based illustration package includes a new typeface-conversion utility, called WFNBOSS, and allows a wide variety of typeface outlines to be brought into *Corel Draw*, including outlines from Adobe Systems, Agfa Compugraphic, and Bitstream, among others. Furthermore, the new release adds 45 Corel typeface outlines to the program for a total of 102 bundled fonts. Each face can be manipulated by any of *Corel Draw*'s type features and printed to a Windows-supported device. Version 1.1 also includes a clip-art library consisting of 300 images from 12 different vendors and supports the Windows clipboard. This setup allows users to cut and paste illustrations and graphics between *Corel Draw* and other Windows applications. Finally, the addition of CGM import and export capabilities allows the *Corel Draw* user to access images from such packages as *Harvard Graphics*, *Arts & Letters*, and *Freelance Plus*. *Corel Draw*, Version 1.1, retails for \$595. Current registered users can obtain the upgrade for \$99. Corel Systems Corp., Ottawa, Canada; (613) 728-8200.



Version 1.1 of *Corel Draw* includes several new typefaces.

Visual Edge for MCA—Intel's *Visual Edge* printing-enhancement system for the HP LaserJet Series II printer is now available for Micro Channel machines. The system, which improves the speed and resolution of the LaserJet and produces gray-scale images, includes a new, 60-line-per-inch halftone screen, as well as the three screens available on the classic bus model: 70 lpi with 64 levels of gray, 85 lpi with 48 levels, and 100 lpi with 37 levels. (The new screen is available to current *Visual Edge* owners at no additional cost.) A printer driver for Intel's Connection CoProcessor fax board is also included. *Visual Edge* for MCA computers retails for \$895. Intel Corp., Personal Computer Enhancement Operation, Hillsboro, Oreg.; (800) 538-3373.



PC WEEK POLL: C COMPILERS

	Overall Weighted Score	Overall Reliability	Complete & Command Descript.	Overall Perform.	Complete & Organized Document	Document Clarity	Compiling Process Efficiency	Product Support Quality	Value Relative To Cost	Product Support Access
Turbo C 2.0 (Borland International)	81	87	79	84	77	78	86	72	70	83
C Optimizing Compiler 5.1 (Microsoft Corp.)	76	83	80	81	78	74	78	68	67	70
C++ 1.07 (Zortech Inc.)	66	68	64	71	63	63	69	60	58	76

"Microsoft was No. 1, but they have been unseated by Borland." PC Week, May 8, 1989

PC WEEK POLL: SOFTWARE DEBUGGERS

	Overall Weighted Score	Overall Reliability	Effective Programmer Interface	Document Clarity	Complete Command Descript.	Complete & Organized Document	Overall Perform.	Integration With Programming Environment	C Compiler Compatibility	Product Support Quality	Product Support Access	Value Relative To Cost
Turbo Debugger 1.0 (Borland International)	84	89	90	81	81	81	89	88	81	73	72	93
Codewind 2.2 (Microsoft Corp.)	73	80	71	72	74	74	74	74	78	67	64	72

"Borland's Debugger outshines Microsoft's Codewind." PC Week, May 15, 1989

It's two winners in one.

Turbo C,* the core of Turbo C Professional, was the outright winner in PC Week's Poll of Corporate Satisfaction on C compilers. Overall, Borland won with 81. Microsoft* placed second.

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copying the first application and all of its data to expanded memory, extended memory, or a disk file, thus freeing enough RAM for the second application to be loaded.

List Price: \$49.95. **Requires:** RAM depends upon application, DOS 2.0 or later. Varicomp, P.O. Box 23360, San Diego, CA 92123; (800) 876-0400.

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Agfa Compugraphic Soft Fonts Feature Variety of Faces

NEW

With PostScript printing rapidly gaining popularity in the PC community, there's been a growing demand for professional-quality PostScript-compatible soft fonts. Two new collections of font products from Agfa Compugraphic, makers of *Type Director*, should help meet that demand.

The Professional Series of soft fonts currently consists of more than 85 separate volumes, each costing approximately \$169, for a total of 410 Adobe PostScript typefaces. Averaging four to six typefaces per volume, these fonts are compatible with any PostScript output device. The fonts take advantage of Adobe Systems' advanced hinting technology, which is designed to create crisp and clear type even at low resolutions. Furthermore, the font-generation algorithm compresses the original outlines, reducing the amount of disk space needed to store the fonts.

The Professional Series typefaces can be used in conjunction with Agfa Compugraphic's other collection of fonts, The Studio Series. The Studio Series is made up of 26 volumes of user-defined PostScript-compatible typefaces, with four typefaces per volume. Unlike the Professional Series faces, these fonts are unhinted and unencrypted, allowing users to manipulate the outlines to produce creative type. This series is especially suited for designing large-point headlines and titles, and each volume includes 250 predefined kerned pairs.

List Price: The Professional Series (over 85 volumes), average \$169 each; The Studio Series (26 volumes), average \$169 each. **Requires:** PostScript-compatible output device. Agfa Compugraphic Div., Agfa Corp., 90 Industrial Way, Wilmington, MA 01887; (508) 658-5600.

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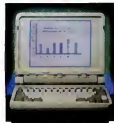
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Changing Times Force Quadram to Split in Two

Last issue, I described how Quadram Corp. had sold its successful line of JT Fax boards to Hayes. Now Quadram's parent, Intelligent Systems, has sold an even bigger chunk of one of the PC industry's charter members.

In July, National Semiconductor Corp. acquired the

Quadram name and the marketing rights to many (but not all) of Quadram's boards and peripherals.

The current Quadram product line will be split between a Quadram division that National Semiconductor is starting and Q/Cor, a new marketing arm that Intelligent

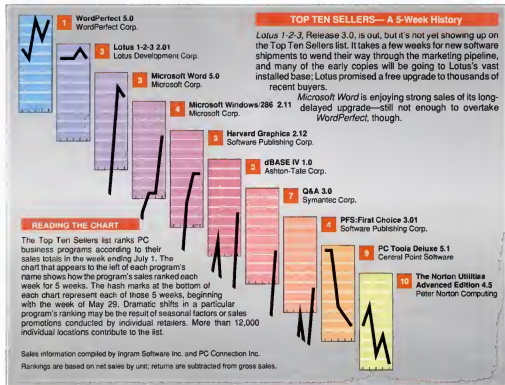
Systems will create. Quadram Corp. isn't being sold, but the Quadram brand name will become the property of National Semiconductor.

All micro-to-mainframe products, peripheral sharing devices (Microfazer), and graphics boards go to National. The rest of the split gets confusing: PS/2 memory boards, except for the PS/Q, go to National, for example. The Quad386XT accelerator board and token-ring network

boards stay with Q/Cor. New packaging will be created for the boards that stay with Intelligent Systems.

Quadram is really the latest victim of a trend that IBM started when it introduced the PS/2 family in April 1987. With video, clock, peripheral ports, and memory upgrade slots built into the system board, the market for board makers shrank dramatically. Compaq soon put more functions on the system board, and today

CONTINUES ON PAGE 64



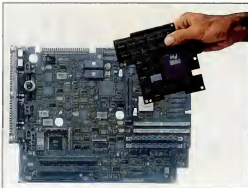
Pipeline

CONTINUED FROM PAGE 63

it's a rare machine that follows the original PC design, where every extra feature, including serial ports, is an add-on board option.

The Quadboard, announced in 1981, was one of the first multifunction boards for the original PC. Over the years, dozens of multifunction boards provided all manner of functions missing from the PC.

Intelligent Systems still owns Datavue (maker of Spark laptops) and Brier Technology (which is developing a small high-density removable disk). The company sees itself as a vehicle for nurturing promising technology ventures, raising them to maturity, and then moving on to the next frontier. It recently went through this cycle with Princeton Graphic Systems. And it's been successfully pumping life into Peachtree Software, the accounting line, for the last year. Expect to see more small companies taken under the Intelligent Systems wing.



Will IBM's Power Platform be the first 486 product? Maybe not, but it's the first one announced.

IBM Planning Major Software Effort

IBM has never had much luck developing software for the PC. DOS and DisplayWrite have been best-sellers for years, but neither was developed by IBM for personal computers. (DOS is a Microsoft product, and DisplayWrite is an adaptation of a dedicated word processor.)

Finally recognizing both the enormous profit potential in PC software and the great sea of programming talent

outside the company, IBM has set out to buy software programs and market them under its own name.

One of the first examples is the codevelopment agreement IBM just signed with Delrina Technology. Soon after Delrina's *Per:FORM* was named Editor's Choice in a *PC Magazine* roundup of forms management software ("Forms Software Fills In the Blanks," June 13, 1989), Delrina announced an agreement to develop an

OS/2 version jointly with IBM.

As IBM scouts hunt for more game, rumors persist that the company will acquire Software Publishing Corp. Even if the deal falls through, it's likely that IBM's software developers will join with Software Publishing in at least one venture.

The 486 Becomes an IBM Technology Display

Intel hasn't gone into mass production of the 486 yet and doesn't expect to for months to come, but IBM is already pushing the envelope of preannouncement 486 hype.

Big Blue plans to sell a 25-MHz 486 plug-in module for the Model 70 A21 this fall. The \$3,995 adapter, called the Power Platform, will replace the system's 386 with a card that contains only the 486 chip and circuitry needed to adapt the processor to the system.

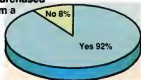
AST and ALR announced similar upgrade plans for existing machines, but it's likely that the 486 will be most at home in a large system built to provide plenty of I/O options.



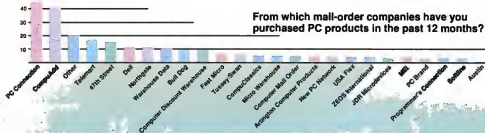
SURVEY

Do mail-order buyers always shop for the best price? That's debatable. In a recent survey of 1,104 callers to PC MagNet, we found that brand loyalty applies to mail-order services, too. In follow-up questions, we discovered a correlation between the most-popular mail-order houses and a ranking of each company's reliability.

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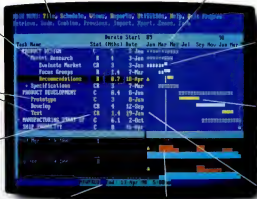
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Bill Machrone



Like the corner candy store, the corner computer store has been replaced by a range of competitors, from specialty boutiques to software supermarkets.

Quick. Where's your closest computer store? I'll bet you can name two or three within easy driving distance. But finding one wasn't quite so easy when I tried to check out a few in Atlanta recently. I copied down the addresses of several candidates from the phone book, then asked the hotel concierge if any were close by. Most of them were out in Buckhead and I was downtown. Her face brightened, however, when she saw Egghead on my list.

"Oh, I pass this one every day on my way here," she said; she produced a map and gave me walking directions. The street address didn't agree with the one I had copied from the phone book, but I figured, what the heck, it must be a new store. When I got there, instead of finding the usual sign and racks of software, I found tables, chairs, and menus. The Egghead was a breakfast joint.

So much for the ranking of computer stores in the memory of the average person.

For those of us more caught up in the computer whirl, such stores play an important—and changing—role. *PC Magazine* has always been about spending your money wisely, but we have usually focused on what to buy, not where to buy it. There's actually a lot at stake in finding the right place to buy your hardware and software. So in this issue, all of our columnists are addressing the topic of computer stores and the retail channel.

Conventional wisdoms need to be retired. Today, you can find dealers with prices equal to or better than what mail-order outlets offer, and you can find mail-order houses with excellent support, on-site service, and a healthy interest in corporate sales. And, of course, you can still get hand-holding aplenty, especially through value-added resellers.

In fact, VARs have emerged as the heart and soul of the vertical markets for packages such as legal software, practice management systems, and others too specialized and demanding to make it onto dealers' shelves. You deal with VARs for what they know and how well they can support you, not for how much they cost. You select them based on individuals and how well they meet your needs and mesh with your organization.

Interestingly, Unix is healthiest in this cor-

ner of the channel, where a 386 box running Unix and a bunch of terminals is found to be a cost-effective alternative to a handful of PCs configured as a LAN. Of course, the applications running on these systems tend toward the mundane. Character mode is the rule of the day, and inexpensive terminals address this need very nicely.

SPECIALTY SERVICE

Some computer stores try to bridge the gap between sales and service by selling retail out of the storefront and supporting customers with specialized needs out of cubicles in the back. An Entré store near me is reputed to be the best place to buy AutoCAD, for instance. The shop started out with a hot dog who did a great job of supporting her customers. Her track record brought in other customers, the store hired more AutoCAD jocks, and now word of mouth has made it a self-sustaining business.

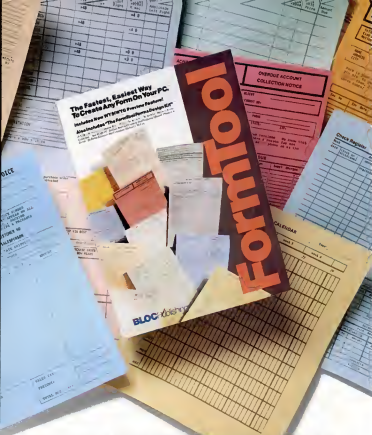
At the other end of the spectrum is the soft-



ILLUSTRATION: TED ORMAN

ware store. The idea is obvious—after all, video and audio software is almost always sold separately from hardware.

But it took Egghead Discount Software to make these shops a big thing. Egghead carries around 1,300 titles, several hundred of which are on display in a typical store, and the rest of which can be ordered for delivery in a couple of days. Software publishers compete fiercely to have their programs carried by Egghead. New



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Bill Machrone

titles come in almost constantly, and old ones are dropped from the list in a steady trickle. The list of accessions and deletions is a chronicle of who's hot and who's not in the software business.

The Eggheads I visited were remarkably similar. Between business programs, educational programs, and games, IBM-compatible software dominated, occupying about half of the floor space. Although they clearly had not spent much time at a keyboard, the salespeople were well trained and could answer questions about the features and benefits of a wide variety of packages. In one Egghead, I didn't see *Lap-Link*, but the salesperson told me that the store could get it in 24 hours. Another store had neither *Lap-Link* nor *The Brooklyn Bridge*, but, again, both could be had in 2 days or less.

By contrast, my local Nynex store proved to be a cold and forbidding place, amply confirming my impression from conversations on PC MagNet that you would be ignored, if not thrown out, if you weren't in business attire. I arrived wearing jeans and a sweater and bearing a long shopping list. I never got to the list. I barely rated a glance from the nattily attired sales staff. There were no other customers in the store.

At a ComputerLand, I described a hypothetical application, one that would require a multisite distributed database system. The salesperson assured me that a LAN would solve my problems, although I might have to wait for OS/2 to do some of the things I was looking for. How long? "A couple of months." I assured him that I would come back when it was ready.

Software Etc. focuses on home office computing—an interesting idea, but frankly, I don't get it. Other than a natural desire to spend less, how is computing at home different from computing in an office building? Occasional users in both settings have the same tendency to use simple, integrated packages. Power users are going to want the best tools, regardless of cost. There may be a tie-in to other high-tech home business appliances, such as fax machines and copiers, but that's about it.

Some experts say that computer stores as we know them are headed for the last roundup, that they'll be replaced by superstores. If the support is no worse and the prices are better, it may be inevitable. ■

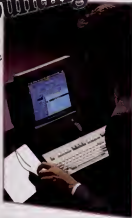
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software packages
easier to use.**

According to Diagnostic Research, MS-DOS users regularly use an average of 3.7 software packages on their machines and are familiar with an average of 10.3 packages. By contrast, Macintosh users average 5.8 packages in daily use and are familiar with 16.3 packages.

There is a growing population in the PC community—the Dead-End Users. These are the people who use their PC to run just one application or maybe two. They don't want it to do any more than it already does. They are not interested in discovering new uses for their machine. They are either intimidated or bored by the thing. It's pathetic.

And the statistics quoted above are optimistic. Others have claimed that the average MS-DOS machine is used for as few as 1.7 applications. Many of us are familiar with Lotus users who cannot even leave the Lotus shell. They even use Lotus add-in word processors to write memos. Few of these people even know what the DIR command does. Is it ignorance or fear?

It's apparent that the software developed and sold for today's PC user is too difficult to use. Far too many packages require a week-long course at a junior college to understand. Software has changed from being "user friendly" and benefit oriented to "user hostile" and laden with gratuitous features. Most of today's hottest software packages are jammed to the gills with excess code and superfluous fluff.

PERFECT POOP OUT

Take *WordPerfect 5.0* (please!). While there is no denying its success, I have to wonder if the user community has gone wacko in embracing this program. Since WordPerfect Corp. is considered one of the best-managed software companies and one with decent marketing moxie, I hope that these are the factors accounting for its success. My mother-in-law has spent her life taking courses on how to use this product. She also uses a spreadsheet and says she's too pooped to learn anything new. Her MS-DOS usage? Two products.

Long ago, the PC user community failed to demand a standard user interface where, say, the F1 key is *always* the help key and the Esc key *always* walks you back out of the menu in the order you entered. The biggest loser in this

lost battle is the old *WordStar* diamond for cursor movement, which a few die-hards kept pushing and promoting to software developers who would say "Why?" or "Unix doesn't have it." *WordPerfect's* help key is F3. Where did they get that idea?

While conventions come and go, none have become universal enough to encourage users to try more software. Users don't want to spend weeks learning package after package just because programmers can't even agree on where the help key goes. I have reviewed packages that are simply impossible to use unless you wrote the code—all because of the lack of a standard set of user interface conventions.

This situation will eventually kill the PC. IBM's Systems Application Architecture (SAA) is an attempt to correct this, but the community of PC users is in such disarray, and there is already so much disagreement, that it seems unlikely that SAA will ever be accepted. The standard of excellence is the Macintosh operat-



ing system. Its imitator, *Microsoft Windows*, is clunky by comparison and fails to implement, among other things, the notions of desk accessories and system folders, both of which make the Mac effortless to modify and use.

Still, the real problem is with the applications. They are too hard to install, too hard to run, finicky about TSRs, buggy, far too complex, and difficult to use.

This is not progress. It's a dead end.

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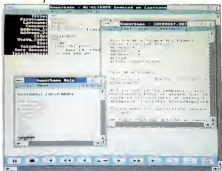
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John C.
Dvorak

Inside Track

Look for **Iomega**, specialist in turning unusual and cutting-edge technologies into products, to outdo itself with a disk drive based on so-called **digital paper**. This "paper" is actually a thin mylar film medium, similar to floppy disk medium, that uses an infrared-sensitive dye to record data written by a laser beam. The new Bernoulli Optical drives are slated to hold a **gigabyte per disk, with 40-millisecond access times!** The kicker is that a digital paper disk is supposed to sell for \$50 a disk, compared with \$500 for a WORM disk of the same capacity. This is going to be the technology that people will be talking about in the months ahead. The drawback is that it's write-once, read-multiple (WORM). So its first use will be limited to archive and image storage.

Digital paper was invented and is manufactured by the 22-billion-dollar Imperial Chemical Industries of Great Britain. Iomega plans to release a **5¼-inch 1-gigabyte "floppy" disk drive** sometime next year using this stuff. I'd sell short my stock in streaming backup tape drives if I owned any.

PIXAR's Worst Kept Secret Dept.: This new disk drive may be just the ticket for saving images produced by the upcoming graphics **add-in card** we can expect to see coming from PIXAR, the old LucasFilm start-up company that Steve Jobs bought. The company, which started as a high-end real-time computer animation hardware maker, seems to be turning its sights and fractals in the direction of the PC. Specifically, toward **386 machines**. We'll see what comes of it within the next 9 months. Let's hope it's VGA compatible!

What's Wrong with This Picture Dept.: Apparently, the maker of a product called the **Big Blue Disk** was sued for trademark infringement by IBM, a company that, at least until recently, has eschewed the nickname **Big Blue**. Nonetheless, Softdisk Publishing, maker of the Big Blue Disk, can't afford to be **bled to death** by IBM litigation over this issue.

The curious aspect of all this has nothing to do with Softdisk Publishing. Apparently, IBM **doesn't give a hoot** about its or the disk. According to those familiar with the case, IBM is blocking the use of Big Blue for some "no comment" reason. The company, it seems, got wind of some competitor coming out with a computer or company name or something called Big Blue that would **impinge** on IBM's market or image. Nobody seems to know what the product is. Perhaps it's a soft drink or a nasty new mixed-drink concoction. Then again it might be a new line of **antacids** or even prophylactics. My guess: a Sesame Street character.

Fashionable Laptop Update Dept.: Yes Virginia, there is a new player in the laptop arena. Headed by a founder of

Sun Microsystems, **Dynabook Technologies** has finally introduced a portable laptop that makes the "Dvorak

Recommends" short list. This company is **not to be confused** with the CD-ROM Dynabook people who, I'm told, will change their name. Priced competitively with the Zenith SupersPort 286, but with a 16-MHz clock speed, VGA graphics, two serial ports, a **magnesium body**, and a detachable screen, this machine proves to me that the best designers are right in California. I really like this unit. It will be the "in"

laptop for the next few months. Now where are those chic leather carrying cases we need for these things?

Check This Out Dept.: If you get the chance to see the line of **Ricoh portable imaging equipment**, then do so. It's a portable copying system that interfaces with a portable computer. This stuff is great fun for convincing everyone that you're from **another planet**.

Genuinely Interesting Hardware Dept.: While on the subject of laptops, here's a device that should get some sort of award for audacity, if nothing else. It's a **\$95 joystick interface card** that fits into the internal Toshi-slot found on most Toshiba laptop models! It lets you use

two joysticks with any game that supports the IBM standard game port. The flir for the product boldly says, "... you can always tell everyone you got it to use with your CAD software." A good joystick, a hot game, a laptop, some extra batteries, and this baby is perfect to drive fellow passengers **nuts** on long overseas flights. It's from Adtron Corp. in Gilbert, Arizona. Call the company at (602) 940-0060. Adtron also makes prototyping breadboards for the Toshi-bas.

Genuinely Interesting Software Dept.: My final piece of advice for those with laptops such as the Toshiba 1000 or the NEC UltraLite who are looking to save space on their RAM-disks. Use **Q-Edit**, a \$59 word processor that is only 52K in size and is **blazingly fast**. Compare that with the 92K needed for the old versions of **WordStar** or the 200K (or more!) needed by anything else. **Q-Edit** can be configured to look like any other word processor (mine uses **WordStar** commands). It uses paths, has windows, and works with straight ASCII text, making it perfect for e-mail. It also gives you a **large supervisible "block" screen cursor**, so it's ideal for those hard-to-read LCD screens. Forget those costly utilities! You can even make it highlight the entire line you are editing. **Q-Edit** is a great piece of software. **Highly recommended.** What doesn't it do? (a) Fancy formatting, or (b) right justification. Neither of which is needed on a laptop. Do yourself a favor and order a copy. Call the designer, Sammy Mitchell, at SemWare Software ((404) 428-6416). ■

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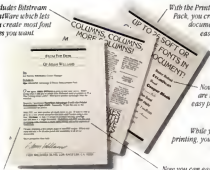
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Jim Seymour



**Why can't computer
dealers deliver
the same quality
of salesmanship
as other retailers?
Here's how
it ought to be done.**

It's just not true that all computer retailers and salespeople are terrible. Let me tell you about the best computer salesman I know.

He has a better understanding of products he sells—IBMs, Apples, Compaqs, HP LaserJets, Hayes modems, a reasonable range of application software, and Novell networking software—than many daily users of those products. He can do effective hands-on demonstrations of them—and does, at length, to his prospects.

With every sale of a computer or major peripheral (such as a laser printer), he comes to the buyer's office or home and installs the equipment. When the process of delivery and installation is complex or time-consuming enough to require a technician, he still comes out and holds the buyer's hand while the technician hooks up the equipment. A week after a sale, he calls the buyer to make sure he's happy. Three months later, he calls again.

If a new customer mentions that he was recommended by a previous customer, he sends the previous customer a thank-you note. And if the new customer actually buys a system, the previous customer finds a messenger at his door with a bag of cookies, or a box of chocolates, or a bunch of flowers.

When his customers' equipment comes in for service, he tracks its progress through the shop. If there are unexpected delays, the customer gets a call from him, not from some sleepy technician.

This paragon of virtue must work in a fancy computer boutique, huh? One of those list-plusten places, probably? And people pay through the nose for that kind of service, eh?

Well, no. He works at a ComputerLand store. And the prices he quotes to customers are competitive with the lowest prices in his market area. I know: I spend a lot of money with him. Oh, and one more thing: he makes \$100,000 a year.

Yes, he really exists. And no, I'm not going to give you his name, because that would be unfair to other good computer salespeople.

Every time people tell me they've never met a good computer salesman, I tell them about this guy. In fairness, I've never met another one as good as he is. But I've run into a lot who are damned good.

THE RIGHT KIND OF SALESMAN

The secret, I'm convinced, is getting computer retail sales out of the hands of aging computer junkies and into the hands of the right kind of sales professional.

That does not mean the kind of guy who sold cameras in the '60s, stereos in the '70s, computers in the '80s—and never understood how to use any of them. And it doesn't mean hiring supersalesman types with flashy suits and snappy patter. It means hiring and training well-paid people who know at least as much about the art of selling as they know about computers.

My favorite salesman knows more than enough about computers, though he's graceful enough to insist that he learned most of what he knows from his customers (a gentle fib). But his computer expertise isn't why he's such a big success. The reason people flock back to him for second and third and tenth major purchases, and steer their friends and employers to him, is because he attends to the simple, traditional de-



ILLUSTRATION BY TED DEWAN

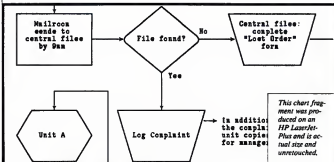
tails of salesmanship.

In the buying process, he respects his customers' intelligence. He makes them comfortable by spending time with them, so that when they reach a buying decision, they're happy—not uneasy—with their choice.

After the sale, he shows up on the customers' doorsteps to help them each get the new computer or peripheral up and running. He does this whether they're computer wizards or



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Jim Seymour

computer tyros. I don't need someone to help me get an HP LaserJet Series II connected, but when the guy I just spent the better part of \$2,000 with shows up with the printer, remembers the cable I forgot to ask for, and sits and chats with me for a few minutes while I plug things together, I feel stroked.

Of course those installation visits let him size up the nature of a customer's business and possible future needs. And his post-sale calls let him make sure that things are still running right, as well as convincing his customers that he wants them to be satisfied with what they bought.

**What sounds magical
in the PC business
is the norm in many
other fields.**

The whole process, of course, encourages referrals. And his acknowledgments of those referrals cement that bond: "Thanks for the vote of confidence. What else can I do for you to earn that trust?"

DEMAND THE BEST

For some readers, this must sound otherworldly. If your experience in computer stores has been with those ill-mannered, ill-informed salespeople who are all too common, my salesman must sound almost mythical. That's the saddest part of this story. Because what sounds magical in the PC business is the norm in many other fields, many of whose goods carry far lower ticket prices than PCs do.

We get the computer salespeople we demand. If we put up with pushy or diffident types who don't know what they're doing, we'll get pushy or diffident types who don't know what they're doing. But if we demand, seek out, and spend our money with knowledgeable salespeople who show interest and treat us with the respect due to someone spending from \$2,000 to \$10,000, we'll improve the breed. ■

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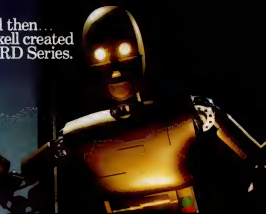
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CIRCLE 134 ON READER SERVICE CARD

William F. Zachmann



Retail computer merchants should face the facts. Mail order and specialty houses add just as much value without adding to the price of their wares.

One of the things that really amazes me is that I haven't heard a version of the "three biggest lies" joke with a punch line about computer retailers. The major role of jokes, after all, is to make us laugh while cleverly pointing out ways in which reality makes mincemeat of conventional wisdom.

Received opinion about computer retailers (and computer resellers, in general) is often so far from reality that I'm amazed that there isn't already a complete joke book on the topic. Many truisms on the matter are already close to being jokes.

The first, of course, is the one about computer retail stores' justifying charging higher prices than do other reseller channels by virtue of the wonderful service, support, and training they offer. That ought to be good for a laugh simply on the mere repetition of the claim.

Sure, some conventional retail computer stores really do a pretty good job of it. These, however, are the exception rather than the rule. On average, rug merchants offer service, support, and maybe even training superior to that offered by the majority of computer merchants!

It has been my practice since the early days of personal computing in the late '70s and early '80s to visit as many retail computer stores as I can whenever I travel. I've been to computer stores all over the world.

To find out for yourself the real level of expertise, service, and support available from computer retailers, you can simply repeat my experiments. Just visit as many computer stores as you can and ask three or four moderately complex questions about products you are thinking about buying and need (or can pretend that you need) information about.

If you can get the attention of one of the salespeople (which, as my colleague John C. Dvorak pungently pointed out several weeks ago, can be a very big *if* indeed) you will readily discover that retail computer salespeople are typically unimpressive in their level of knowledge and expertise.

To be kind about it, I'd say that computer salespeople, on the average, have about the same level of expertise on computers that car or appliance salespeople have on the products they sell. In fact, those selling computers probably

fall a bit short of meeting the standards for auto and appliance salespeople. But, after all, computers are inherently a bit more complicated, so let's give them (the computer salespeople, that is) the benefit of the doubt.

So if you are lucky enough to find a local computer store where knowledgeable salespeople offer first-rate service, support, and training at no additional cost, by all means count your blessings! But if you don't find all this in the store around the corner, there is no reason to think that you are unusually unfortunate, either.

JUST AN EXCUSE TO CHARGE MORE

For the majority of computer retailers the whole "value added through service, support, and training" bit is more an excuse for charging more than other channels do than it is a serious commitment on their part. They are much more ready to claim the added revenues from their supposed "value added" than they are to spend the money necessary to provide it.

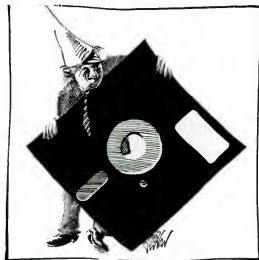


ILLUSTRATION: TED DEWAIN

Another fact that you can readily verify for yourself is that many nonstandard resellers (those other than the traditional storefront operations) have more-knowledgeable salespeople and provide better service, support, and sometimes even training than do many of the conventional retailers. That has been demonstrated to me many times.

I once made an experiment with a test inquiry concerning hard disk cards. The salesperson

William F. Zachmann

in one of the Businessland stores I visited hadn't any idea what I was talking about. I actually had to take him over to a counter where some of them were on display and say "I'm asking about products like these!" The ComputerLand store down the road was only marginally better.

Yet, the fellow at the counter at 47th Street Photo (now also 47th Street Computer) immediately understood what I wanted: he intelligently and knowingly spelled out what his store carried and what the prices were, and he offered suggestions on the pluses and minuses of the brands offered.

I've found a similar situation in the field of software. Many ordinary retailers barely offer any software at all (except for a

small number of very popular titles) and know little about what they do carry. Discounters like 47th Street and software specialty stores like Egghead typically offer far more titles and far more knowledgeable salespeople, as well.

At the same time, specialty software resellers like Corporate Software have long made the best of what ordinary storefront operations offer in the way of knowledgeable support look like amateur operations. Corporate Software, in fact, offers much better software support not only than the conventional retail chains, but than the software vendors themselves, at least for many products.

And when it comes to really complex products like Unix systems and local area networks, most ordinary computer retail-

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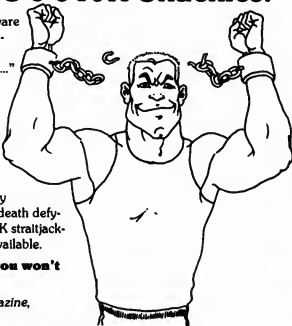
Winn L. Rosch, PC Week,
December 19, 1988

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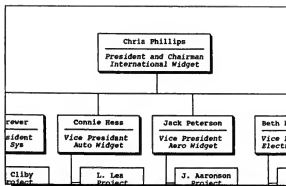
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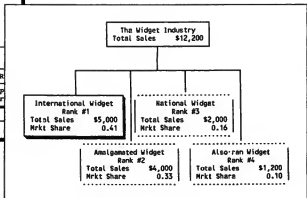
I'd just as soon
see retail computer
merchants face the
fact that they
aren't really that
much different from
rug merchants and
price their wares
accordingly.

ers haven't a clue. Sure, there are outfits like MicroAge that make a serious effort along these lines and can be of tremendous help. But the average is way below that of the few capable exceptions.

For my money, I'd just as soon see retail computer merchants face the fact that they aren't really that much different from rug (or auto or appliance) merchants and price their wares accordingly. Until they do, though, I'll stick with buying direct, through mail order, or from discount or specialty resellers like 47th Street, Egghead, or Corporate Software. These outfits realize that lower prices are a terrific way to deliver real value and, to boot, they equal or exceed most conventional retailers in "value-added" aspects of service and support.



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Stephen Manes



Once you've been
to Chapter 11,
you know what retail
is all about.

"It's an arfin' Cadillac showroom," Uncle Donald said as we walked into Dagbert's, the new computer store up at the Northbelt Mall. "Except Compaqs ain't Cadillacs."

The place was enormous. And spotless. And tasteful. It was divided into little islands, each devoted to a particular price range or type of hardware. There were four or five desktop islands, and a laptop island, and veritable archipelagoes for peripherals, software, and networks. Dagbert's was clearly trying to establish an upscale image. Uncle wasn't buying it.

"This'll never work," Donald kept saying. "Never. You can't waste space and inventory like this. That's why in most computer stores what you see is a roomful of unopened boxes." Donald had once been in computer retailing himself. After that, he was in Chapter 11.

A personable fellow wearing a natty double-breasted suit and a badge that read "Eric Redstone, Sales Consultant" hurried over to greet us. "Would you gentlemen prefer to try our triple-roasted Sumatran or our aged Javanese?"

"Is that new hardware?" Uncle Donald asked. "Or software?"

"Coffee," Eric replied pleasantly.

Uncle Donald leaned over and whispered in my ear. "What it is is a Rolls showroom. But I don't see any mainframes."

"Sumatran," I told our Sales Consultant.

"Black for me, cream and sugar for him."

"Gotta watch the ulcer," Uncle Donald explained, patting his tummy.

"Browse around. I'll be right back."

HARDWARE WONDERLAND

Donald went straight for the circular table of 386 machines. Half a dozen machines, from an IBM Model 80 to a truly ugly Dagberti clone, were set up on a lazy Susan. Every one had a jazzy animated menu program on the screen. You could sit down in a comfortable chair, pick programs, and play around with any computer you wanted to try.

"They spent a fortune on this!" Donald said, shaking his head. "Normally, the only things you see on the screens in these joints are lame IBM self-running demos and 'Abort, Retry, Fail?!' Wait, look at this—they've got a switch box so you can mix and match machines

and monitors! And hey! Amazing! Price tags—with *real* prices!"

"What's amazing about that?"

"Nobody puts price tags on hardware in this business," he said. "You deal. You dick. You haggle. Maybe some sucker comes in fresh off the boat and pays list."

"Maybe these are just a starting point."

"You kidding me? I know this business. There's almost no margin here. Drop these numbers and they're in the red."

Eric came back with steaming mugs. The Dagbert's logo on them was so tiny you needed to squint to see it. "Keep the mugs as our gift. What can I help you with?"

"These prices," Uncle Donald sniffed. "Is this the best you can do?"

"Well, sir," said Eric, "feel free to shop around. We're confident our prices are the lowest in the area."

"Maybe for quantity one," Uncle Donald admitted. "How about for a hundred?"



"We offer a standard volume discount to all our clients," said Eric. "It's right there on the back of every price tag. And you can mix and match items to get your discount. How many units are you considering?"

"Oh, just one," Donald replied, then whispered, "Watch how fast he disappears."

"We'll be delighted to have your business," said Eric, with no sign of vanishing.

Shaking his head in disbelief, Uncle Donald

Stephen Manes

flashed him The Look. He was going to try his trick question. "Tell me," he said, "is there really any difference between this IBM Model 80 and that cheap 286 clone over there?"

"Quite a difference, sir," said our Sales Consultant, "and I'll be happy to go over it with you. But first let's browse through this." And with a couple of mouse strokes, he deftly brought up on the Dagbert's screen a detailed, accurate comparison of the two machines.

"This database must have cost a bloody fortune," Uncle Donald muttered. "But what does all this stuff mean to me as a user?"

Eric launched into a 286-versus-386 discussion that would have done Bill Machrone proud. He pointed out some of the lower-cost 386 options, carefully discussing the likelihood of manufacturer-supported versions of OS/2 for the clones.

"Where'd you learn all this?" Uncle Donald asked in exasperation.

"We have training sessions three times

a week. And we love our jobs. And computers. If you don't, you won't last long here."

THE SOFTWARE ARCHIPELAGO

We sailed into the Archipelago of Software, where a couple dozen machines were running enticing demos of everything from games to C programming utilities. A huge menu of software was available for test drives.

"This is beyond belief," Uncle Donald snorted. "They can't make money on this. Even the good stores have maybe two working demo machines. You wait in line behind some kid who's queuing for the rank of Exalted Grand Pooh-Bah, a geek who's trying to teach himself *PageMaker*, and some nut who comes in every quarter to *Excel* his company's financial statement. Then you finally try to give the new version of *WordPerfect* a whirl, and you discover somebody has stolen the template. You got a template, Eric?"

"If we don't, we'll open a brand-new box to get one."

Uncle Donald shook his head. "What's your service policy?"

"We're authorized to service every

product we sell," Eric replied. "If we can't fix your unit within 24 hours, we'll provide a loaner."

"Kid," said Uncle Donald gravely, "find yourself another job. Your boss is giving away the store!"

Eric frowned. "This is a service-oriented business."

"But it ain't high tech, Eric. It's retail. Which means discount. Which means one-digit margins. Or no-digit margins. Plus spiffs and push money. Which means cut-throat. Which means all you got time to do is move the product out the door and then move some more. Eric, I been there! I tried it! I know!"

Eric excused himself and went to fetch coffee for another customer. "Poor kid," my uncle said. "I give him 3 months at the outside."

Exactly 31 days later, Dagbert's was padlocked and "Closed for Remodeling." A couple of weeks after that, I found Eric behind the counter at Espresso Bingo.

"Career change, huh?" I said.

"Nope," Eric replied with a grin. "Still in retail. But for real this time. You know what the margins are on a dollar-and-a-quarter cappuccino?" ■



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CIRCLE 237 ON READER SERVICE CARD

THE GUI An Interface You Won't Outgrow

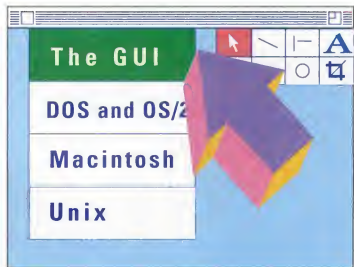
by Jim Seymour

Graphical user interfaces. They're the wave of the future—or maybe they're already here. Everybody needs one—or maybe a lot of us don't. They run strictly in graphics mode on expensive, graphics-equipped PCs—except for the ones that run very nicely, thank you, on plain-vanilla character-only PCs. They eliminate typed commands by allowing users to point at little icons on-screen and click with a mouse to direct the computer to do something—except that most don't eliminate typed commands, don't use icons for everything, and have keyboard equivalents for all that mousing around.

Confused? Good. So were we.

Graphical user interfaces (GUIs, pronounced "gooeys") have drawn the attention of computer scientists, computer programmers, computer users, and the computer press for a decade now. Out of pioneering work done at Xerox Corp.'s Palo Alto Research Center in the 1970s came the Xerox Star workstation, which

Graphical user interfaces are popping up all over the PC industry. This guide will help you make the move from today's command line interface to tomorrow's GUI.



begat the Apple Macintosh, which begat *Microsoft Windows*, which begat Hewlett-Packard's *NewWave*, which begat Microsoft and IBM's OS/2 Presentation Manager, which begat Sun Microsystems' *Open Look*, which begat Open Software Foundation's *OSF/Motif*. Lawsuits were born along the way, too, but if you're looking for late-breaking news on who's suing whom, look elsewhere; we're far more interested in the products themselves.

REALITY BEHIND PRETTY PICTURES

Despite its long and tangled lineage, the GUI is still far from being universally accepted by users, still far from being a real marketplace standard. But somewhere in there is the core of a great idea. Many of us at *PC Magazine* are fond of graphical-interface operating environments and the application programs that run under them. We use GUIs with varying frequency—from occasionally to most of the time. We

The graphical user interface (GUI) is far from being universally accepted, but it is the core of a great idea.

have developed strong opinions about what's right and what's wrong with present-day GUIs. And most of us agree that, sooner or later, most PC users will work in graphical environments.

The big question for PC users today is, as executive editor Bill Howard puts it, "When do these things get real?"

For users of such popular PC programs as *PageMaker*, *Microsoft Excel*, *Micrografix Designer*, and *Ventura Publisher*, GUIs already are real—because those programs run only under specific GUI environments. And for users of such DOS extenders/environments as *Windows*, *GEM*, and *DESQview*, the concept of GUIs is not new, because to varying degrees those programs deliver a graphical user interface.

For the features section of this issue, the associate editor was Mary Kathleen Flynn, and the PC Labs project leader was Bill O'Brien.

For the rest of us, GUIs may still be a matter of some confusion. And that's why we put this special report together—to show you what GUIs have to offer the business user, what they'll cost you (both in cash and performance penalties), and where they're headed over the next couple of years. Since GUIs are cropping up all over the PC industry, we've included products that run on operating systems—such as Unix—which we usually wouldn't touch with a 10-foot pole.

DRAWING THE LINE

So what is a GUI anyway? The working definition we've developed for this story is simple: a GUI is a user interface that runs in a computer's graphics mode. That means, for example, that as much as we like Quarterdeck Office Systems' *DESQview*, it doesn't count as a GUI. Similarly, Brightbill-Roberts's exciting new *HyperPad* interface didn't make the true-GUI cut. (Despite their lack of strict graphical operation, these two products offer some of the benefits associated with full-fledged GUIs. For more on these products, see the sidebar "GUIs Without Graphics") It also means that, as much as we appreciate the audio aspects of systems from Apple, NeXT, and—most recently—Emerson Computer Corp., we're concentrating here on the graphical component of the user interface.

While researching this story, we asked Microsoft Corp. for its definition of a GUI. As the largest PC software company, the largest supplier of application programs for the Macintosh's graphical environment, the creator of DOS and *Windows*, and the primary developer (with partner IBM) of the *Windows*-like OS/2 Presentation Manager interface, Microsoft has become a center of development, and cheerleading, for graphical user interfaces. Microsoft chairman Bill Gates has long been the loudest voice in support of the advantages of GUIs. By releasing its revolutionary Lotus-killer spreadsheet, *Excel*, for the PC almost 2 years ago in graphical-interface form only (running under a bundled, limited version of *Windows*), Microsoft has put its money, and a good chunk of its future, where its chairman's mouth is.

THE VIEW FROM REDMOND

As its competitors and detractors will be happy to shout, Microsoft doesn't know everything about everything—and certain-



ly not everything about GUIs. But more people at Microsoft have been thinking about and working with GUIs for longer than at just about any other company. The definition the folks at Microsoft penned is good but too subjective for our purposes. In Microsoft's terms, a true GUI satisfies these six requirements:

- It exploits bitmapped displays, offering true WYSIWYG screen representation of printed output.
- It is a graphically oriented interface, making extensive use of icons.
- It has good screen aesthetics: it looks good and is a pleasure to work with.
- It allows direct manipulation of on-screen elements, allowing word processor users, for example, to grab and drag left and right document margins rather than having to calculate and type in specific measurements.
- It embraces the object-action paradigm, so that the user chooses an object first, then selects the action, freeing up the user from an action sequence that must be completed before moving onto the next task.
- It offers standard expected elements—such as menus, standard window elements, and dialog controls—to provide consistency across applications.

Additional elements Microsoft thinks GUIs should incorporate are

- Application support: a strong set of user-interface controls and tools to build apps.
- Consistency across platforms as well as across apps.

GRAPHICAL USER INTERFACES

- Ease of use and visual appeal, ease of installation and configuration, enjoyability.
- Productivity: WYSIWYG, information communicated through graphics.
- Flexibility: support for a keyboard or mouse as well as for a range of devices and peripherals.
- User customization and personalization.

Microsoft also identifies multiple-application support as essential to a successful GUI. The good GUI can run multiple graphics applications at once and support interapplication communications with such tools as dynamic data exchange, messages, and clipboards.

Unfortunately, Microsoft's own GUI products, as issued so far, fall short of this criteria.

THE GOODS ON GUIs

For PC users, the issue isn't how GUIs work, nor who makes them, nor what Bill Gates thinks of them. The real issue is what they can do for you. Save time? Make programs easier to use? Reduce the learning curve? Make programs more powerful? The answers are yes, yes, yes, and yes.

Because it offers standardized commands from one program to the next, a good GUI will save you time in both the learning and the use of applications. For example, the steps involved in printing a text document created with a word processor or a financial statement created with a spreadsheet ought to be the same if both programs run under the same GUI. This way, you'll already know how to print when you install a new app, and you can spend your training time on learning the nifty features that persuaded you to buy the program.

A QUESTION OF STYLE

GUIs can also make applications more powerful. In theory, the programmer's choice to design a program with a character-oriented interface or one with a graphical-oriented interface shouldn't determine its features and depth. In practice, however, many power-user features are so complicated that they're impractical in command-line-driven programs. Scrolling through an on-screen dialog box of *Excel's* mathematical functions and clicking to insert one in a worksheet, for example, is certainly technically possible with programs that ask users to type commands into character-based displays. But without

Excel's graphical interface and style of working that GUIs inspire, it would be messy at best and hideously complicated at worst. The services required to drive that interface are provided by the underlying *Windows* code, and the impetus for both programmer and user to implement that feature comes from the rich tools built into that graphical interface.

The GUI style of working is one benefit that has sometimes been underestimated. When Apple released the Macintosh in 1984, a number of software developers rushed out hasty conversions of their DOS hits; they didn't take time to rethink how users would want to work with those programs in the Mac's graphical universe. Many of these vendors finally pulled the failed products off the market in embarrassment. Software developers do well to

The issue isn't how GUIs work, nor who makes them. The real issue is what they can do for you: save time, make programs easier to use, and make them more powerful.

remember that a program that retains its old command and interface structure when ported to *Windows* or the Presentation Manager from DOS can hardly be called a graphical application. Instead of being easier to use, it will feel clumsy to users, who are likely to stay away in droves.

PM IN THE DRIVER'S SEAT

In addition to the PC community's increasing awareness of the benefits of graphical user interfaces, the release late last year of Version 1.1 of OS/2, with its Presentation Manager graphical interface, has given a new urgency to the GUI question. Whatever you may think of OS/2 in its present form, its substantial advances over DOS—from much larger available memo-

ry to almost-crashproof multitasking—mean that OS/2 is going to become the next major standard in the PC world. Without the PM interface, that probably wouldn't be possible.

But operating systems and user interfaces aren't worth anything to users until applications written for them appear. We don't work with operating systems, whatever flavor the interface may be; we work with applications. Never fear, PM apps are here, and more are coming (see the chart "Where the Apps Are and Where They're Going").

The slick look and feel of the Presentation Manager, combined with the extensive "services" available to programs running under it, have already made it popular with application software developers, who are pouring their resources into a new round of OS/2-PM programs that will finally form that class of "next-generation" products we've been expecting for the last 2 or 3 years. At present, Microsoft, Micrografx, Aldus Corp., Borland International, and other software houses are finally shipping, or about to ship, OS/2-PM applications.

It's time to take GUIs seriously.

POWER HUNGRY

It's impossible to separate the question of the validity of GUIs from the cost of the hardware they demand. Let's face it: GUIs are computing resource hogs that sop up all the CPU power they can find.

Reasonable GUIs would never have been possible on the PCs and PC-XTs of yesterday: the slow CPUs, limited RAM, and (usually) low-resolution monitors of those days would have made GUIs seem . . . gooey. Indeed, many people argue today that only the fastest 80286-based PCs can reasonably support GEM- and *Windows*-based applications, that in fact it takes a 20-MHz 386 to make a happy *Windows* user.

The demands on the hardware that result from writing all those pixels to the screen, dot by dot, and redrawing (or refreshing) the screen image as you scroll up and down are enormous. Even today's medium-high-resolution video graphics array (VGA) standard puts 307,200 pixels, or points, on the screen. To redraw that many individual pixels in anything like real time, as you type or scroll or jump from the top of a file to the bottom, stretches the ability of even fast CPUs. (Of course, not all of the computing power demands laid at the feet of GUIs are the result

of adopting a graphical interface—operating systems themselves take up plenty of computing resources.)

HELP FROM HARDWARE

Fortunately for GUIs, video adapters, displays, and graphics coprocessors are improving steadily. The days when character-based displays were the norm on PCs and graphics-capable displays the exception are clearly over.

As the IBM video standard has ratchet-

ed up from the abysmal CGA to the tolerable EGA and now to an acceptable VGA, we have gradually moved to on-screen resolutions that are capable of supporting GUIs. The widespread adoption of the 640- by 480-pixel VGA standard, fostered by IBM's inclusion of it without additional charge (and without the loss of an extra expansion slot) on Micro Channel-bus PS/2s, has brought economies of scale in

production to a graphics standard that has been the first to deliver reasonable GUI performance.

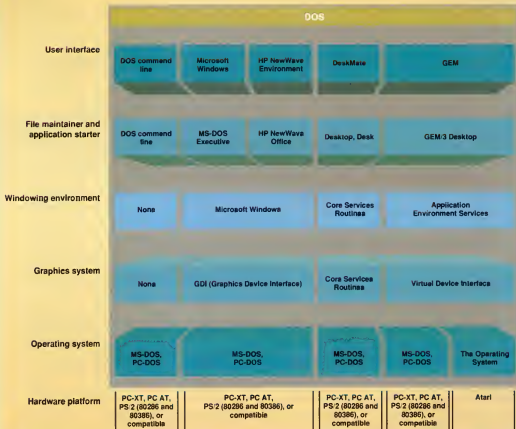
IBM's promotion of the still-higher-resolution (1,024- by 768-pixel) 8514A standard has put an emphasis on graphics performance that will continue today's advances toward higher resolution and more colors on-screen. Although the 8514A has flaws (flicker, for one), it offers a very nearly ideal display environment for GUIs.



THE FIVE LAYERS OF USER INTERFACES

Graphical user interfaces, which promise to take over the C:\> prompt on your desktop, are sprouting up on operating systems all over the PC industry. From the Macintosh desktop to the Presentation Manager, these

GUIs share a similar structure. To see how they compare with the DOS command-line interface you're used to, take a look inside the five layers of user interfaces.



COVER STORY

GRAPHICAL USER INTERFACES

At the same time, the PC industry is rallying around the 800-by-600-pixel "Super VGA" (SVGA) standard, also called the VESA standard after its industry boosters, the Video Electronic Standards Association. Super VGA can be achieved on much of the installed base of multiscanning monitors simply by replacing the video card. Super VGA looks a lot better than regular VGA, and with two or three windows open and processes under way concurrently, the higher-resolution display begins to

show why GUIs are so important and so useful.

Help is also on the way in the form of graphics coprocessors from Intel Corp., Texas Instruments, and Hitachi. The newest generation of video boards can take over management of the screen-redrawing process without putting such a load on the CPU. Thus these boards allow faster graphics performance, make GUIs accept-

able on a wider range of PC power levels, and help any PC make the most of its computing power.

The cumulative effect of these hardware developments is to fuel the boom in GUIs. For many PC users, gaining satisfactory GUI display performance means simply upgrading to a new video card. For all PC users, it's likely that your next system will be delivered right out of the box with enough display power to handle GUIs easily.



STAYING BEHIND

Not everyone agrees that superpowered operating systems with power-hungry graphical interfaces are needed for most of what we do with PCs. I've often heard this argument: "Most of the PC work in my office is pretty mundane: production typing, for example, of standard text-only documents under *WordPerfect*; or plugging the new month's figures into tried-and-true *Lotus 1-2-3* spreadsheets; or keeping customers' accounts straight with our PC-based bookkeeping system. We use a mix of mainly 8088-based PCs, with some 6-MHz and 8-MHz ATs. There's not a mouse in the office. We wouldn't gain a thing from going over to a fancy GUI."

The secret: that argument is correct. Not everyone needs, wants, or is willing to pay the tab for GUIs. And that's perfectly OK. If most of the word processing in your office is straightforward—a 1980s update of the 1950s "typing pool" model—then moving to GUI-based software won't do much for you. Or if you're happily using 1-2-3 for expense accounts and other two-dimensional rows-and-columns stuff, and if you don't care much about graphs, or consolidating results from several work-

sheets into roll-ups, or turning out prettified hard copy, then moving to GUI-based software won't offer much to you, either.

While it's almost inevitable that you will move to a graphical system at some point in the future, there's no need to make that move till you're sure the payback will justify the effort and cost. There's nothing wrong with staying in a backwater of computing—as long as you know that that's what you're doing and as long as you know why you're doing it.

NOT FOR ARTISTS ONLY

But consider the experience of users of Apple's Macintosh. The first widely available, reasonably priced GUI computer system, the Mac changed how a lot of PC users thought about their work. There's a misconception that the typical Mac user is someone who was already predisposed toward the graphical world—maybe an artsy type, maybe a designer. That view would make some of the gruff bankers, securities traders, engineers, and others who rely on Macs laugh out loud.

Mac business users discovered that the

case of cutting data out of one application and pasting it into another—one that, because it ran under the same highly standardized GUI, knew the form the incoming data would take and could make use of it immediately—led them to take computing a step or two further, getting more quickly to better results. They found that there's nothing frivolous about turning out a few graphs to help sell an idea to management or a client. And they discovered that, when it's easy to fold graphics into text passages in reports, you can make a point more quickly and more persuasively than by using words alone.

These are the lessons that *Windows* and *GEM* users are learning now, and that Presentation Manager users will learn in the near future.

MICROSOFT'S OFFERINGS

Long in the habit of looking to IBM and Microsoft for leadership, most PC users and developers are focusing their GUI sights on *Windows* and the Presentation Manager. Are those products ready for prime time? Is *Windows* just a bridge product from today's limited DOS world to the multitasking, multithread, multimegabyte

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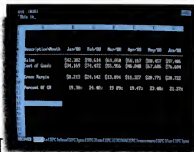
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COVER STORY GRAPHICAL USER INTERFACES

world of tomorrow? Will the PM ever get its rough edges smoothed out? Where will each go from here?

Though the current version of *Windows* falls short of Microsoft's own definition of a graphical user interface in some ways, it has become the standard GUI in the DOS world. (See the sidebar "What's Wrong with Windows?") Since its initial release in November 1985, *Windows* has come a long way—especially in the jump from the slow and clumsy Version 1.x to the not-quite-so-slow, not-quite-so-clumsy version 2.x. It gained in the move to 2.0, and now to 2.1 (also known as *Windows/286* and *Windows/386*), more and better display and printer drivers, better use of memory, and the ability to display overlapping—not merely side-by-side (tiled)—windows. In the process, it evolved from a curiosity to a working tool.

Windows/386 is a far more complex, robust, and useful product than *Windows/286*—but only if you have a 386 PC. If you do, the program's ability to manage several concurrent windows, each displaying a different program running in its own virtual PC, is a true productivity booster. And *Windows/386* can free you from the

tyranny of pop-ups that don't pop up: you can run your most-important pop-up utilities as freestanding, non-memory-resident applications, each in its own window.

Windows/386 lets you create standard

The current version of
Windows has become
the standard GUI in
the DOS world.

sets of programs that otherwise cannot run together. You might have *WordPerfect*, 1-2-3, *Crosstalk Mk.4*, and *Hot Line II* all active at once. Normally *Crosstalk* won't run in the background with other DOS programs, but under *Windows/386*, it isn't running in the background: it has its own window to its own virtual PC.

All that takes a lot of memory, of course. Though memory prices are falling, multimegabyte upgrades still aren't cheap. But then, neither is your time.

GETTING READY FOR TOMORROW

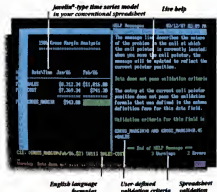
What's coming? Look for new versions of *Windows* this fall. They promise faster performance, more intelligent use of system memory, and easier file management than current versions. The visual components of the shell will be more graphical, more intuitive, and more interactive.

The Presentation Manager is also getting an overhaul, the results of which should show up in the next release (1.2) of OS/2, due by year's end. The PM shell will be cleaned up visually; convergence between the look of *Windows* and the Presentation Manager will be evident.

OS/2 itself is due for a new file system in Release 1.2; the new system will support long filenames and extended attributes. Still in the future are the truly object-oriented file system Microsoft has promised and the 386-specific version of OS/2, which will finally take advantage of today's fast 386 hardware. A developers kit for 386 OS/2 (now called OS/2, Ver-

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sion 2.0, internally at Microsoft) is expected to be shipped this fall, and the version intended for end users should be shipped sometime in the first half of 1990.

OTHER DOS CONTENDERS

In the meantime, *Windows* isn't the only DOS-based GUI available. *GEM/3 Desktop*, from Digital Research, offers a similar environment, and *DeskMate*, from Tandy Corp., is a good GUI solution for beginning and/or home computer users.

GEM, which has been out since March of 1988, is a useful product. However, it's spawned few significant applications. Since graphical operating environments are only as useful as the applications that run under them, the future for GEM does not look especially bright. Xerox's *Ventura Publisher* is the only major application that runs under GEM; a few scanner control programs and a line of interesting but not widely used applications from Digital Research—the best of which, *Airline*, is a superb desktop publishing aid—round out the dim picture.

DeskMate, Tandy's entry in the GUI sweepstakes, was originally a character-mode GUI-like entity that came free with Tandy's low-end Model 1000-series PC compatibles. Since then, *DeskMate* has grown up into a true graphical-mode environment that Tandy sells separately.

DeskMate may be the easiest-to-use, shortest-learning-curve graphical interface ever designed. It includes a few so-so mini-applications and is now beginning to attract full-fledged applications support from vendors of introductory-level PC software.

Tandy has further enhanced the value of *DeskMate* by developing an extended-capability add-on product, *Workgroup*, that brings Tandy's easy-to-use GUI to LAN users. Running on 3Com, Tandy and many so-called "zero-slot" LANs that use PCs' RS-232 serial ports, *Workgroup* offers superb telephone messaging, very good electronic mail, group calendaring, and more.

THE OBJECT OF HP'S AFFECTION

In all the talk about new graphical interfaces for PCs, one product not yet delivered, from a company that has never made much of an impact in PCs or PC software, holds almost-mythic status in the minds of programmers and the few PC users who have actually seen demo versions. To see it is to be captured by a vision of computing as it has never been.



WHERE THE APPS ARE AND WHERE THEY'RE GOING

The best PC applications are on their way to graphical user interfaces. Whether they began life on DOS, the Macintosh, or Microsoft Windows, these products will grow up on the OS/2 Presentation Manager.

After Fall Comdex, it's unlikely that you'll see a single major application introduced that doesn't run on Windows or PM. Ashton-Tate, for instance, will migrate its Macintosh software to PM, leaving some DOS apps to die.

The accompanying diagram includes the products PC Magazine editors consider the best in each category. The icons and arrows show where these packages are today and where they're headed.

Predicting the future is always tricky. We've based our forecasts on product announcements and general statements of direction. As a package migrates, its name and features often change. For the sake of simplicity, we've used the product's original name.

	Macintosh	DOS	Microsoft Windows	GEM	OS/2 character mode	OS/2 Presentation Manager
WORD PROCESSING						
WordPerfect						
Microsoft Word						
SPREADSHEET						
Microsoft Excel						
Lotus 1-2-3						
DATABASE						
Paradox						
COMMUNICATIONS						
Relay Gold						
HyperAccess						
GRAPHICS						
Persuasion						
PowerPoint						
Adobe Illustrator						
Micrografx Designer						
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Organization Made Easy.
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The product is the *HP NewWave Environment*, from Hewlett-Packard Co. *NewWave* is in effect a shell on top of a shell, sitting atop *Windows* (and someday, HP says, the *Presentation Manager*) and bringing to these current and future standards the enormous advantages of object orientation. *NewWave*—the *Windows* version of which HP says will be available by press-time—proves that, despite Microsoft's delays, it's possible to run an object-oriented file system on top of the famously kludgy file systems of existing versions of *Windows* and *DOS*.

What's so important about object orientation?

Consider this scenario. You sit at your PC, seeing what looks remarkably like a *Windows*/*Presentation Manager* display. But instead of the usual long, dreary lists of obscure filenames, you see rows of named icons. One might be called *APCO LTR*, another *APCO GR*, another *APCO SS*. Click with your mouse on the *APCO LTR* icon. Immediately your *Windows*-compatible word-processing program loads, then opens that text document, *APCO LTR*. Scroll through the letter. Notice that table near the bottom of the first

page? That's a patch from an *Excel* spreadsheet, *APCO SS*. Notice the graph near the top of the next page? That's *APCO GR*, also from *Excel*—or maybe from another *Windows* graphics program; it doesn't matter. Click on that spreadsheet patch, or on the graph, and the program associated

The PC will never be as easy to use as the Mac because of demands placed on PC GUIs.

with it pops up so that you can edit it. Make a change anywhere and it will ripple back through all of the associated documents—without intervention by you.

That's what's so important about object orientation.

Object-oriented design has been showing up in applications as well as in operating environments. One application that has taken object-oriented design to its logical extreme is Wang's *Freestyle*. Visually attractive, metaphorically consistent, and very easy to use, *Freestyle* is a DOS application that starts with a GUI and adds workgroup communications tools—such as voice addendums and handwritten messages to files. It promises a taste of tomorrow's environments today. (For more on *Freestyle*, see the sidebar "Beyond the GUI: Wang's Freestyle.")

STATE OF THE MAC

Any discussion of GUIs isn't complete without a look at the Apple Macintosh's System and Finder duo, the most fully realized graphical user interface in general use. With 5 years under its belt, the Mac interface has outgrown most of its original shortcomings, and in the process has provided an ongoing field laboratory for interface-design specialists trying to determine what we really want.

Apple's experience with the Mac's operating system has led to a rewrite of the system from the bottom up. It will look



MP386



MP286



MP386s



mp286L

much the same—the human interface qualities of the Mac's system are by now both well proven and widely accepted—but will provide more-robust services beneath that surface, to better support application programs.

Apple also hears footsteps coming from the PC-compatible world and is rewriting the Mac's System/Finder to help stave off the huge leaps and commensurate marketing advantages coming in PC-compatible GUIs and operating systems.

APPLES AND ORANGES

A comparison between the Mac's interface and PC GUIs is certainly tempting but not very productive. Charles Petzold—the proprietor of *PC Magazine's* Environments department, a recognized expert on OS/2-PM, and one of the reviewers for this article—puts it simply: "The PC will never be as easy to use as the Mac, period. This isn't because of any intrinsic failings in the PC's GUI. It results from certain demands placed on PC GUIs that Apple doesn't have to deal with."

"First, the PC is an open-architecture machine; the Mac is not. A GUI that can potentially support every graphics video

display and every graphics printer ever made for the PC is going to be more complex than one that needs to support only one video display and two printers, as was the case with the original Mac.

"Second, because Apple didn't achieve much early penetration into corporate America, it can ignore compatibility with existing systems. *Windows* and *OS/2* have to run DOS programs, and they have to work with the existing DOS file system. I guarantee you, if Apple had put complete Apple II compatibility into the Mac, it would have lost a lot of its simplicity.

"IBM has been much more successful than Apple, so IBM is bound by much tighter constraints."

UNITING UNIX

While Mac users enjoy the most intuitive GUI out there, and while DOS and OS/2 users can choose from a full palette of GUIs, the Unix user must wait for the arrival of GUIs that are still in the labs.

Long seen as capable and powerful but variegated and hostile to users, Unix is now becoming more standardized and

more friendly. Efforts are being made to convert the many incompatible versions into one binary code standard, which will make possible true cross-system compatibility of Unix applications. In addition, Unix supporters have recently recognized that, if it is to go head-to-head with OS/2-PM in the high-end networked-office-systems market, Unix must put on a kinder, gentler face. So the Unix community is also pointing toward delivering Unix with one standard graphical interface.

Although the Unix community seems relatively united on the binary-compatibility issue, when it comes to the user interface turf, the Unix industry is split into two warring camps—Sun and AT&T vs. The Rest of the World. So far, the outcome has been to delay the standardization of the "look" of Unix. The Sun group has advanced *Open Look*, an aesthetically appealing and highly functional graphical user interface, as the proposed Unix standard interface. At present, *Open Look* exists only on the new SPARCstation computers from Sun. The rest of the Unix vendor community has rallied around the Open Software Foundation's *OSF/Motif* graphical interface. *Motif* has two big

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backers and one huge advantage: Microsoft and IBM support *Motif* over *Open Look*; and *Motif* is a near-twin of the *Windows/Presentation Manager* interface.

NUMBERS WILL TELL

The question, perhaps sadly, isn't which is better (remember how the superior Beta-max standard lost out to the inferior but much more widely supported VHS standard in consumer video cassette recorders?) but which gathers the widest support most quickly and thus overwhelms the other by sheer numbers. Whether or not *Open Look* is used more widely in the near future, it seems increasingly clear that *Motif* will win this war—in large part because of its strong family resemblance to the dominant graphical interface in the PC-compatible world today (*Windows*) and the interface almost certain to dominate the PC-compatible world tomorrow (the *Presentation Manager*).

The resemblance also offers an appealing glimpse of the future for computer users: a world in which the interfaces on virtually every small to medium-sized computer system—from standalone DOS machines up through networked OS/2 and Unix machines—would have essentially identical interfaces. That would mean sharply reduced training costs for corporations employing a mix of the three systems, more options and less grief for those buying and mixing systems, a broader base of applications, and a much easier time for computer users who must move from one platform to another.

RIGHT FOR TODAY

All this paints an enticing picture of tomorrow. But what about today? While more-advanced operating systems, such as OS/2, still haven't hit their stride, let alone their peak, you can get a lot of value and productivity out of GUIs in their present forms.

If you're persuaded of the advantages of a graphical user interface and have a medium-power PC—say, a 12-MHz or faster AT clone—look at *Windows/286*. It's a good real-world answer that will fit your existing hardware. Remember, though, that you'll want at least 2MB of RAM in the machine, a VGA or better display and video card, and a mouse to get *Windows* off the ground.

If you use an 80386 or 386SX PC, first consider *Windows/386*. It's a big leap up in functionality from plain-vanilla DOS, and virtually all of your current application

programs will work just fine with it. Again, add to the cost of the *Windows/386* software any display or memory upgrades you'll need—and consider buying at least 4MB of RAM.

The new releases of both flavors of *Windows*, due by year's end, will show dramatic improvements. If you're wavering, *Windows 3.0* will change your mind. As executive editor Bill Howard quips, "It's that good."

FAITH IN THE FUTURE

If you have a 386 PC, lots of memory, and an abiding faith in the future of power-PCs and power-GUIs, invest in IBM's OS/2, Version 1.1, with the *Presentation Manager*. Or look for an OS/2-PM release from

GUIs are here now.

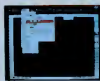
They deliver real value
and show where
personal computing is
headed. We think you'll
decide that this is
going to be a graphical
user interface world.

the maker of your PC compatible. (You can't buy OS/2-PM from Microsoft directly; it sells the product only through its hardware-vendor licensees.) Buy plenty of memory.

And keep an eye out for early PM-compatible application software releases. (See the chart "Where the Apps Are and Where They're Going.") You can run your existing DOS applications, one at a time, in the creaky DOS-compatibility box of OS/2-PM—but why would you?

GUIs are here now. They deliver real value and show clearly where personal computing is headed. In the in-depth reviews that follow, you'll meet all the contenders and a couple of the pretenders. And we think you'll decide, as we have, that this is going to be a graphical user interface world.

NEW!



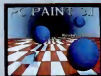
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Jim Seymour of PC Magazine says: "I don't often get this excited about a utility program... If you're half as interested in mice as I am, you really owe it to yourself to have a look at 'MarqPlus.' Even if you're a crusty 'real men don't use mice' type, take a look!"

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GUIs for DOS and OS/2

The graphical user interfaces that PC users care most about are the ones that run on DOS: *Microsoft Windows*, Tandy's *DeskMate*, and Digital Research's *GEM/3 Desktop*. You'll find in-depth reviews of these GUIs on the following pages.

First, contributing editor Charles Petzold reviews *Windows*, the most popular GUI in the DOS world. *Windows* boasts the largest installed base and support for the most applications on today's PCs. (See the chart "Where the Apps Are and Where They're Going.")

Contributing editor Luisa Simone then shows that Tandy's *DeskMate* is a good option for users of 8086-based PCs, but that it may have a limited usefulness for anyone tempted by business apps, most of which have yet to move to *DeskMate*. Tami D. Peterson takes a look at *GEM/3 Desktop*—a powerful package with a less-than-certain future. The best reason to use *GEM/3 Desktop* today is for Xerox's *Ventura Publisher*.

For a glimpse of a DOS GUI that looks promising, see Petzold's review of Hewlett-Packard's *HP NewWave Environment*, due out by the time you read this. *NewWave*, which will run on *Windows* plus DOS and eventually on PM plus OS/2, offers an exciting implementation of object orientation.

The star of our GUI show is the Presentation Manager, also reviewed by Petzold. PM, which comes with OS/2 1.1, will be the primary application environment for OS/2 and the GUI of choice in the years to come.

If you're wondering what to do until then, turn the page. You'll see that *Windows* provides the best path to PM.

Microsoft Windows is the right interface for PC users today, but the Presentation Manager will be tomorrow's GUI of choice.



Microsoft Windows, Version 2.1

by Charles Petzold

Microsoft Windows is the most popular graphical user interface for DOS. According to Microsoft Corp., over 2 million copies of *Windows* have been sold and distributed since its original release in November 1985. *Windows*, Version 2.1, is available in two flavors—*Windows/286*, priced at \$99, and *Windows/386*, which costs \$195.

Although application support for *Windows* was initially sparse, it has been increasing in recent years and is quickly approaching critical mass. To encourage application support, Microsoft licenses a runtime version of *Windows* to developers free of charge; they in turn make the program available to end users. The runtime version allows you to use the application you've purchased, although it doesn't give you the benefits—such as context switching—that the full *Windows* environment provides.

The primary purpose of *Windows* is to run programs especially written for the GUI, such as *Microsoft Excel*, Aldus Corp.'s *PageMaker*, *Micrografx Designer*, and Samna Corp.'s *Ami*. *Windows* runs these programs in overlapping rectangular windows on the video display and allows the user to switch among them with keyboard and mouse. This gives users a flexibility in moving among applications that is more akin to the way people actually work.

For these programs, *Windows* provides a wealth of user interface components (menus, scroll bars, dialog boxes, buttons, and list boxes) that help give the applications a consistent interface. Microsoft also publishes a *Windows Style Guide* that instructs programmers on recommended standards. The result is that every *Windows* program that stores documents as files has a File menu with an Open option that opens an existing document file. Once you've learned how to use one *Windows* program, you know how to use them all.

DEVICE INDEPENDENCE

Windows also has a device-independent graphics interface known as GDI (Graphics Device Interface). Programs use GDI to display graphics and text on the screen and on hard copy devices such as printers,

plotters, and digital cameras. *Windows* is shipped with device drivers that support many popular video display boards and printers, shifting the burden of supporting various graphics output devices from the application to the operating environment. Thus the disks full of printer drivers commonly shipped with DOS applications are not required for *Windows* programs. Moreover, most *Windows* programs are written so that they treat the screen and printer in a device-independent manner. When new video boards become available, all that's needed is a *Windows* device driver; existing *Windows* applications can take advantage of the new hardware without any modifications.

Programs written for *Windows* can share and exchange data through the *Windows* clipboard. A protocol known as DDE (Dynamic Data Exchange) allows programs to transfer data through interactive links. For example, a bar graph displayed in *Micrografx's Graph Plus* can

reflect changes to data in another application, such as a spreadsheet in *Excel*.

Perhaps the most sophisticated aspect of *Windows* is its memory management. Although *Windows* runs in real mode under DOS, the memory management uses techniques normally available only under protected mode. *Windows* can move code and data segments in memory, discard code segments from memory and reload them from .EXE files, and allow programs to share code and data located in dynamic-link libraries. For example, the code that handles the menu logic in *Windows* is located in a dynamic-link library. Only one copy of this code need be present in memory for all *Windows* applications to use it. This sharing of code helps decrease the memory requirements of individual *Windows* applications. (Dynamic linking is one of several concepts originally developed for *Windows* that have been carried over into OS/2 and the Presentation Manager.)

The primary difference between the two versions of *Windows* 2.1 lies in the

EDITORIAL CHOICES

by Mary Kathleen Flynn

To show you the whole spectrum of graphical user interfaces (GUIs) for business applications, we've included products that run on the full range of PC operating systems. Our GUI lineup includes reviews of four DOS GUIs (*Microsoft Windows*, Tandy's *DeskMate*, Digital Research Inc.'s *GEM/3 Desktop*, and Hewlett-Packard's *HP NewWave Environment*), one GUI that runs under OS/2 (the Presentation Manager), one for Apple's Macintosh (Finder), and five GUIs for Unix (Sun's *NeWS*, Sun and AT&T's *Open Look*, the Open Software Foundation's *OSF/Motif*, *PM/X*, and NeXT's *NeXTStep*). We've included fact files for only the DOS- and OS/2-based GUIs.

In addition to the full-fledged GUIs reviewed here, we've devoted a sidebar to two products (Quarterdeck Office Systems' *DESQview* and Brightbill-Roberts & Co.'s *HyperPad*) that don't fit our definition of a GUI (they don't run in graphics mode) but that do offer some of the benefits associated with GUIs. Another sidebar covers Wang's *Freestyle*, which begins with a GUI and ends by showing us a glimpse of things

to come. We've also included a sidebar on IBM's new OfficeVision. All the products in this story meet one common criterion: they each have a significant presence in the business community.

You won't find any benchmark tests in this story. Such tests just can't measure the look and feel of a GUI; nor can they weigh the subjective benefits—such as ease of use and a shortened learning curve—that GUIs offer.

Without formal tests and without such controls as a common operating system, we have declined to bestow the Editor's Choice on a particular GUI. Let's just say the Editor's Choice goes to the graphical user interface itself. But we haven't changed our minds: We still vote for *Windows* today and for the Presentation Manager tomorrow.

In the following reviews, you'll find descriptions of each GUI, plus advice about what to buy and when. Since your buying decision depends ultimately on the applications that will run under your GUI, we've evaluated application support for each GUI in these reviews and have included a chart to help summarize our findings. ■

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In the current versions of Microsoft Windows, the MS-DOS Executive is the user's interface to the file system and the applications; it's also in charge of application launching. The Control Panel handles system configuration and printer installation.

way they run DOS programs that were not written for the *Windows* environment. Under *Windows/286*, *Windows* usually has to step out of the way and give a DOS application the full screen. *Windows/386* uses the "virtual 8086" mode of 80386 microprocessors to window and multitask virtually all DOS programs.

PC FACT FILE

Microsoft Windows, Version 2.1
Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073; (206) 882-8080.
List Price: Windows/286 \$99; Windows/386 \$195.
Requirements: Windows/286: 512K RAM, graphics adapter, DOS 3.0 or later; Windows/386: 80386-based PC (2MB RAM recommended), graphics adapter, DOS 3.1 or later.
In Short: The most popular graphical user interface for DOS, *Windows* promises to make DOS more productive during its last years of widespread use. New versions, due out this fall, are expected to address memory limitations and replace the less-than-intuitive MS-DOS Executive.



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CRACKS IN THE WINDOWS

Windows currently has two major failings. (For information on other frustrations with *Windows*, see the sidebar "What's Wrong with *Windows*?") The first is the MS-DOS Executive, a file-management program that compares unfavorably with many DOS shells. The MS-DOS Executive is almost entirely nongraphical; the main window provides little more than the

equivalent of a DIR command. For people who know how to use DEL, COPY, and RENAME, performing these functions under the MS-DOS Executive is more difficult than using the DOS command line. (Several utilities from other software manufacturers—such as Publishing Technologies' *PubTech File Organizer*, Wilson WindowWare's *Command Post*, hDC Computer Corp.'s *hDC Windows Express*, Matesys's *Simple Win*, and Romberg & Romberg's *Smart Win*—provide friendlier environments for maintaining files and/or starting programs. And if you want to write your own utilities, Softbridge's *Bridge/286* and *Bridge/386* offer a full-fledged batch language for *Windows*.)

Perhaps the most serious problem with *Windows* is the operating system under which it runs. DOS was not designed for multitasking and is limited to 640K memory. *Windows* provides support for expanded memory. But, like any bank-switched memory scheme, expanded memory cannot be used by applications as transparently as normal addressable memory. Using expanded memory can degrade program performance.

Windows 3.0 (to be released later this year) is expected to address these two problems. The MS-DOS Executive is being replaced with a more sophisticated and intuitive interface for starting programs and performing file management. To conquer the memory limitations under real mode, *Windows 3.0* will use protected mode to run well-behaved *Windows* applications. Support for protected mode will allow *Windows* programs to transparently use memory above the 640K DOS limit,

giving them much more elbowroom and significantly improved performance.

PRODUCTIVE DOS

Although many observers expect the OS/2 Presentation Manager to eventually replace *Windows* as the GUI of choice on PC-compatible machines, *Windows* will help make DOS tolerable and more productive during its last few years of widespread use. Furthermore, judging from the improvements expected in *Windows 3.0*, it's obvious that Microsoft is not abandoning *Windows* and will continue to make it better.

When is the time right for you to put *Windows* on your machine? As with any operating system or environment, a decision to move to *Windows* should be based on the availability of desirable *Windows* applications. If the only two DOS applications you run are *Lotus 1-2-3* and *Word-Perfect*, there is little reason to even think about *Windows*. But if you want to fire up *Excel* and *Ami*, then you should be using at least a runtime version of *Windows* (whether you want to or not!).

DeskMate

by Luisa Simone

DeskMate, from Tandy Corp., challenges most of our assumptions about the high cost of graphical user interfaces. Not only does *DeskMate* work efficiently on an 8086—or even an 8088—but it's also fully functional with only 384K RAM. And *DeskMate*, which comes with several *DeskMate* applications, is priced at \$99.95—the same price as *Windows/286* without any apps.

You might think that all of this does you no good if you don't own a Tandy Computer. While it's true that *DeskMate* is shipped in ROM with all Tandy 1000SL and 1000TL computers, it's also available as standalone software for any PC compatible.

Installing *DeskMate* entails copying all of its files to your hard disk and typing the word DESK. Once you've loaded the program, you will have a common look and feel for all *DeskMate* apps. The slightly clunky interface takes advantage of drop-down menus, dialog boxes, radio buttons, and yes, even function-key substitutes for the mouseless among us. An entire suite of programs is bundled with *DeskMate*: Telecom, Test, Draw, Filer, Address, Mail-

WHAT'S WRONG WITH WINDOWS?

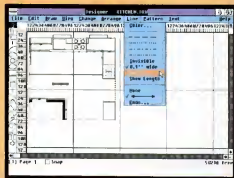
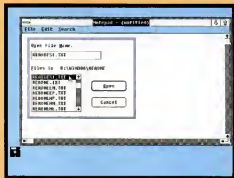
by Bill Howard

What's wrong with *Windows*? Like the Mac, it's bitmapped, somewhat slow, and gives you access to some great applications. Unlike the Mac, it doesn't make a computer any easier to use. But that's about to change.

If the graphical interface has been slow to take off on the PC, it's because *Windows* has been something of a graphical in-your-face for the last 4 years: slow, klunky, not very graphical, and not much easier to use than DOS. Not a very pretty picture for the vanguard of PC-compatible GUIs. Most users who've adopted *Windows* have done so because it gives them access to the originally small (but now rapidly growing) and powerful collection of *Windows* apps. *Microsoft Excel*, *PageMaker*, *Micrografx Designer*, and *Graph Plus* are some of the very best programs that you can buy for the PC, and they all run under *Windows*.

Take a look at the rogues' gallery of screen shots accompanying this sidebar. They're just three examples of how *Windows* lets you down if what you're expecting is the MS-DOS equivalent of the Mac. There are many, many others, among them:

- You can't grab a file with your mouse and drag it from one directory to another.
- You can't zero in on everything related to one application. If you're running *Excel*, for example, you might want an MS-DOS Executive session that shows all .XLS, .XLM, .XLW, and .WK1 files on all subdirectories. It can't be done.
- *Windows* lacks DOS-extending utilities—such as MOVE, the intelligent equivalent of COPY-then-DELETE—that are available on every Tom, Dick, and Harry DOS shell.
- Dynamic Data Exchange (DDE), the *Windows*-approved method of transferring data streams among *Windows* apps, will drive you to tears with its complexity. While the Clipboard is far easier to use, your fonts and line widths may be altered when you clip and paste data between apps.
- WIN.INI, the *Windows* parameters



Trying to find the file you need in the current versions of Microsoft *Windows* is like admiring the countryside from the gun slit of a tank: A list box is typically only eight filenames long and lacks even the information you'd expect from the DOS DIR command, like file size and date.

Microsoft *Windows*' MS-DOS Executive has none of the intuitive ease of use that you find in the Macintosh. Do you see anything on this screen that looks easier than DOS? Or, for that matter, that couldn't be done with a character-based interface?

Most Microsoft *Windows* pull-down menus aren't "sticky," meaning that, if you wanted to change three attributes from this one, you'd have to pull the window down three times. Only a handful of *Windows* programs lets you keep the window down until you're done.

file, can be arcane, and if you want to tweak *Windows* for performance, you're likely to find conflicting advice if you compare *READ.ME* notes in *Windows* and in *Windows* apps.

■ The *Windows* soft font installer can lock you into an apparent lose-lose situation in which your only choices are to reload the fonts you've already downloaded (and waste 20 minutes), deactivate the fonts, or exit by rebooting the system.

Then there's *Windows/386*. Some users find that it crashes too often to be a preferred operating platform. You can tweak *Windows/386* to improve its reliability, but you may not like the terms: forgo TSRs and accessories that use

**Windows gives you
access to some
great applications.
Unlike the Mac, it
doesn't make a
computer any easier
to use. But that's
about to change.**

DMA (Direct Memory Access), like CD-ROM drives. And 800 by 600 Super VGA video drivers for *Windows/386* are all but nonexistent.

Still, there is light at the end of the tunnel. *Windows 3.0*, due this fall, should be a quantum leap forward, with real ease of use (approaching the Mac's), an end to the MS-DOS Executive craziness, object orientation (you can move a file by dragging it to a new directory), and memory management bordering on the incredible. Basically, if you've kept the faith with *Windows* thus far, you're about to be rewarded. *Windows 3.0* is that good. ■

merge, and *Worksheet* provide the most basic of computing capabilities. These applications are also very closely tied to the accessories that come with the product. The *Address* program and the phone list, for example, both use the same data files—so you have to enter the information only once. A pull-down menu that is a standard part of the interface makes the full complement of accessories available from within any *DeskMate* application.

SWITCHING TASKS

When you invoke the accessories menu, in addition to the expected phone list, calculator, or clipboard, you will also see an option called Task Switching. *DeskMate* is indeed a graphical environment, but it has no capabilities for either true multitasking or windowing. Context switching moves you between any two applications, but that's all it does. Even the accessories are limited in this regard. The "windows" in which they appear cannot be resized or moved, and you must close an accessory in order to return to the current application.

Like all graphical environments, *DeskMate* provides device independence to the programs running under it. *DeskMate* supports Hercules, CGA, EGA, and VGA displays. The program also supplies generic drivers for the following printers: an IBM graphics printer, an ASCII printer, a daisywheel printer (for Tandy and IBM daisywheels), and the HP LaserJet Plus. Don't expect the long list of specific drivers that come with *Windows*, and don't expect PostScript support.

However, you'll be grateful for the way in which *DeskMate* handles other peripherals—like mice. Similar to GEM's approach, adding a mouse is as simple as accessing the setup menu and telling *DeskMate* to look for one. Try that in the current version of *Windows* and you'll discover that the only way to add a mouse is to reinstall the program.

DeskMate also incorporates some DOS shell features. You can view your files in a tree structure or you can list them in menu boxes that appear on a metaphorical desktop. The tree gives you a more intelligent look at complicated directory structures. But in either case, double-clicking on a category header or on a filename will invoke the associated program. Of course, *Windows*, and even DOS, allows you to do the same thing, either by modifying the WIN.INI file or by passing a filename as a

PC
MAGAZINE

FACT FILE

DeskMate, Version 3.0
Tandy Corp., One
Tandy Center, Fort
Worth, TX 76102; (817)
390-3700.

List Price: Software,
\$99.95; Workgroup
Companion, \$149.95;
Developer's Kit, \$250
(no royalty).

Note: *DeskMate* is free (and stored on ROM) with
the purchase of the Tandy 1000SL or Tandy
1000TL. Other Tandy models require that you
purchase *DeskMate* as software.

Requires: 512K RAM, graphics adapter, DOS
3.2 or later.

In Short: If you own an 8086, want a graphical
environment that emphasizes ease of use, or just
don't feel like hassling with DOS anymore—try
DeskMate. For \$100 don't expect high-end
functions, but do expect consistent, reliable
performance.

CIRCLE 418 ON READER SERVICE CARD



parameter. *DeskMate*, however, creates the same sort of connections through the courtesy of a simple-to-use dialog box.

Unfortunately, you'll find that you often shell out of the *DeskMate* environment in order to run favorite DOS programs. Although 14 software companies have announced support for *DeskMate*, so far there's still a rather narrow range of business products; only a handful of programs—*Quicken* from Intuit, *Memory-Mate* from Broderbund Software, *Instant Pages* from Electronic Arts, and *PFS: First Publisher* from Software Publishing (which says it expects to port over other apps later)—have taken advantage of the free license that Tandy offers to *DeskMate* developers. And the only graphics program to provide resolution-independent art is Tandy's own low-end, vector-based *Draw* program, which comes bundled with the operating environment.

WHEN LESS IS MORE

It would be easy to say that *DeskMate* occupies a niche as the graphical user interface for 8086 computers. But, in a world where 80286s are quickly becoming the entry-level machine, *DeskMate* may have to compete more directly with *Microsoft Windows*.

DeskMate has less overhead than *Windows*, and that results in a faster response time. *DeskMate* also traps some common operator errors. For example, if *DeskMate* can't find a program in the current directory, it won't give you a cryptic error message. Instead, you'll be asked if you want

WIENER HUT

Get a long little doggie.

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Weiner Speck
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Chips
Pretzels

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Raise the roof.

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Let her roll.

Blake amends

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see von



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Text. Our Catchword™ software converts virtually any typeface into ASCII files for your word processor, desktop publisher, or spreadsheet. It reads horizontally or vertically, scans words or numbers from 6 to 20 point, and matches adjacently scanned columns perfectly.

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In California:
800-552-8885
In Europe: ++41
-21-869-96-56

LOGITECH



*For IBM PC and compatibles, includes PointShow Plus. List price for the IBM Micro Channel version is \$399. Catchword is an optional extra for \$199.

CIRCLE 182 ON READER SERVICE CARD



Save that tiger.

Save face.

Scan the globe.

Take this job
and shove it.

Catch a wave.

Save the day.

Can scan.

There goes the neighborhood.

Scan the horizon.

Get real.

TODAY'S TIMES ONLY
FIELD OF DREAMS
SCANDAL
BARON MUNCHHAUSEN
RENEGADES
NO HOLDS BARRED
A FEW DAYS WITH ME
REACHES
WARM HUGHS ON A SLOW
MOVING TRAIN



For users who don't need the power of Windows, Tandy's DeskMate is a good GUI choice. The Desktop, which the user sets up, contains menu boxes for files and applications, as well as such accessories as a calculator and a calendar.

to scan the entire hard disk in order to locate the errant program.

The next version of *DeskMate* (due in the third quarter of this year) will further distinguish itself with context-sensitive help that relies on event logs and extensive databases. If it works as promised, *DeskMate* will take its best guess at what you're doing wrong and assist you with specific information. Tandy also markets a \$149.95 supplement to *DeskMate* called *Workgroup Companion*, which gives messaging, group-calendaring, and printer-sharing capabilities to users on 3Com, Tandy networks, and RS-232-based LANs.

Anyone seeking high-performance programs will ultimately succumb, not to Windows per se, but to the programs that run in the Windows environment. *DeskMate* poses a unique question in this power-driven, features-intensive market: Do you really need all the power of Windows? If the answer is no, you'll find *DeskMate* a useful companion.

GEM/3 Desktop

by Tami D. Peterson

GEM, or Graphical Environment Manager, is exactly what its name suggests. And *GEM/3 Desktop* is the application equivalent to Windows' MS-DOS Executive; both manage applications and files for DOS from within their respective graphical user interfaces.

Digital Research Inc. (DRI), the developer behind GEM, began shipping the

product in March of 1988. At last count, DRI claimed to offer over 500 different GEM-based applications worldwide. The most significant of these—and some argue that it is the only significant GEM app—is Xerox's *Ventura Publisher*. Some applications ship with only runtime GEM. Others are packaged with *GEM/3 Desktop*, which can also be purchased separately for \$49.95.

Like other present-day GUIs, GEM is a descendant of the early Xerox PARC operating environments. Those familiar with the earliest incarnations, including the Macintosh interface, will perceive *GEM/3 Desktop* as falling very near to the tree. DRI has maintained the essence of the original desktop metaphor in its product. A routine DOS command such as COPY is obsolete in the *GEM/3 Desktop*. It is replaced with the more-object-oriented method of clicking on an icon that represents the document (file) or folder (directory) to be copied, then dragging it onto the document or folder icon it is to replace or combine with.

INTELLIGENT LOGOS

All GEM-based applications will run from within the *GEM/3 Desktop*. So will any other DOS application, including Windows—assuming that you have enough memory. The only difference in using a *GEM/3 Desktop*-installed application is the precustomization. For example, *GEM Artline*, a GEM-based professional graphic designer's tool, displays an *Artline* logo in its *GEM/3 Desktop* application icon. All file-types recognized as *Artline*-compatible have immediate application-execution

capability. This means that double-clicking on an *Artline* file will automatically open the *Artline* program at the same time.

You can easily adapt the same features to any non-GEM application. DRI has already done half the work by automatically recognizing .EXE and .COM files as application files. Thus, the proper generic icon imagery is displayed. To open your favorite word processor from within the *GEM/3 Desktop*, just double-click on its corresponding icon. To customize the icon, *GEM/3 Desktop* supplies a library of various pictorials to suit most any application. For example, when installing *Lotus 1-2-3*, you might choose an icon depicting a page with numbers.

GEM's device independence is outstanding, providing tremendous flexibility to anyone using a GEM application. You can exchange mice, monitors, scanners or printers at any time with a quick device-only install. By comparison, changing a monitor in the current versions of Windows requires a full reinstallation.

IF YOU CAN'T BEAT 'EM...

While GEM is presently a competitor of Windows, DRI intends to migrate it into OS/2 and the Presentation Manager. To the GEM user, this means uninterrupted application usage. To the GEM developer, this means purchasing DRI's *GEM System Layer Presentation Manager (GSL-PM)* programmer's kit. In it are the tools to

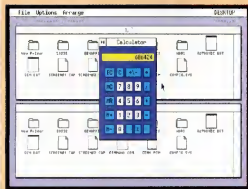
PC FACT FILE

GEM/3 Desktop
Digital Research Inc.,
P.O. Box DRII,
Monterey, CA 93942;
(408) 649-3896.
List Price: \$49.95
Requires: 512K RAM,
graphics adapter, DOS
2.1 or later.
In Short: An alternative to Windows, GEM
boasts 500 applications, but only one. Xerox's
Ventura Publisher is a major player. DRI will
be releasing the GEM System Layer Presentation
Manager, which will provide tools to port GEM
apps to the Presentation Manager.

CIRCLE 419 ON READER SERVICE CARD

"plug" any GEM application into the PM interface. The *GSL-PM* acts as a redirector, translating GEM calls into appropriate PM functions and displays—all the way down to menus and dialog boxes. At presstime, the price for the kit was expected to be approximately \$2,500.

Of course, the success of DRI's strate-



Functionally comparable to Microsoft Windows, Digital Research's GEM/3 Desktop provides a graphical environment to access and uses both GEM and non-GEM applications. Clock and calculator utilities also come with the GUI.

gy depends on applications making the move to PM with GEM. DRI itself will release products for *GSL-PM*; *Arline* appears to be the likely first candidate, and *Chart*, *Draw*, *Graph*, *FirstWord Plus*, *GEM Desktop*, *Publisher*, and *GEM Scan* will all follow. DRI claims that a dozen ISVs are seriously interested in writing *GSL-PM* apps; two that have announced such applications are Precision Software—developer of *Superbase*, a popular database running in GEM—and Delrina, the maker of *Per:FORM*, a forms generation package.

GEM offers many immediate benefits to the end user, and DRI's strategy of moving GEM applications into PM makes GEM a good present-day solution for users committed to *Ventura Publisher* and *Artline*.

HP NewWave Environment

by Charles Petzold

Hewlett-Packard Co.'s *HP NewWave Environment* is an alternative application program for Microsoft Windows. Just as *Windows* runs *Windows* applications, *NewWave* runs *NewWave* applications. But because *NewWave* itself runs under *Windows*, you can run *Windows* apps and *NewWave* programs on the same screen and switch among them. The icon-based *NewWave Office* is the user interface to *NewWave*.

At presstime, *NewWave* is scheduled for release this summer at a price of \$195. (A developer's kit costing \$895 has been available since 1988.) A Presentation Manager version of *NewWave* is also in the works.

Several *NewWave* applications are expected this year, including *Microsoft Excel* and *Micrografx's Graph Plus*. As you can probably guess, *NewWave* applications usually begin life as *Windows* applications. The programs are then modified by the manufacturer to include *NewWave* extensions to the *Windows* application program interface.

DATA + CODE = OBJECT

To understand how *NewWave* is different from *Windows*, it is necessary to delve into concepts of object-oriented design.

Over the past few years, programmers have been discovering how object-oriented design can simplify common programming tasks. Conventionally, programmers have worked with data and code. The code (organized into procedures) manipulates the data. Each procedure that can manipulate a particular data type must know how the data is stored in memory.

In object-oriented programming, a programmer works with objects. An object is a combination of data and code. More precisely, an object is an instance of a particular data type called a *class*. The class is defined not only by the way in which the data is stored in memory but also by all the operations, called *methods*, that may be performed on the data. To manipulate an object, the program sends the object a

message that tells the object to perform a particular method on itself.

Some elements of object-oriented design are already present in *Windows*. In particular, a *Windows* program creates various windows that are treated as objects within the program. But the *HP NewWave Environment* brings object-oriented design principles directly to the user in the relationship that occurs between application programs and the documents that they manipulate.

Under more-conventional environments—and for this comparison, *Windows* is certainly conventional—users work with applications and documents. (Applications and documents correspond to the procedures and data of traditional programming.) To work with a particular document file, the user must start up the application, load a document file into memory, use the application to manipulate the document, and eventually print the document and save it. The application can then be terminated.

Within *NewWave Office*, a user works with objects—the document files that are linked to particular application programs. *NewWave Office* displays these objects using the name of the document and an icon that represents the application program. To work with one of these objects, the user

FACT FILE

HP NewWave Environment
Hewlett-Packard Co.,
Personal Software
Division, 3410 Central
Expressway, Santa Clara,
CA 95051; (800) 752-
0900.
List Price: \$195
Requires: 80286 or 80386-based PC, Microsoft
Windows 2.0 or later, 2MB LIM 4.0 expanded
memory recommended, 20MB free disk space,
EGA or VGA, mouse (Windows compatible),
DOS 3.2 or later.
In Short: Running on top of Windows, *NewWave*
is an alternative application environment.
Due this summer, *NewWave* brings object-
oriented design principles directly to the user. A
Presentation Manager version is in the works.

CIRCLE 421 ON READER SERVICE CARD

simply selects the object. *NewWave* then invokes the application.

TRANSPARENT APPLICATION LAUNCHING Of course, you can do something like this in *Windows* today. *Windows' MS-DOS Executive* can start up particular applica-

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The HP NewWave Environment lies on top of Microsoft Windows. The HP NewWave Office is what the user sees. Documents—icons with folded corners—display the document name beneath an icon that represents the application associated with the document.

tions based on a filename extension, but in all cases, a Windows application is started up to create a new document or to load an existing one into memory. A NewWave application, on the other hand, can be started up transparently (and invisibly) to perform certain specific tasks on an object.

For example, to print a document in the NewWave Office, you need only move the document icon to the printer icon. The document is printed without any further user interaction. (Using object-oriented terminology, the user is sending a message to the object to print itself.) The application is obviously started up in some way (because only the application knows how to print the document), but the application need only print the document and then terminate. The application doesn't get in the way. The user doesn't even have to know which application is printing the document.

If you're still not impressed, consider this: NewWave objects need not be associated with only one application. For example, you can extract part of a spreadsheet to insert into your word processing document. This is a common practice in both DOS and Windows, but usually the spreadsheet fragment is converted to a simple ASCII format and no longer retains any formula or formatting information. In NewWave, the object remembers which application is associated with the spreadsheet fragment. If you select the spreadsheet fragment within the word processing document, NewWave will invoke the spreadsheet application to allow you to make changes. Both the word processing

and spreadsheet applications share in the display and printing of such a document.

The bad news (at least for the programmer) is that NewWave doesn't make Windows programming any simpler. A NewWave programmer needs to have a good background in Windows—itsself certainly not an easy system—before attempting to deal with the NewWave extensions.

I won't venture a prediction about the success of NewWave in the Windows and (eventually) the Presentation Manager markets. But even if NewWave turns out to be merely a feasibility study, it is of extreme importance. NewWave shows a future direction for graphical user interfaces that is just too powerful to be ignored.

OS/2 Standard Edition 1.1

by Charles Petzold

OS/2 was developed by IBM and Microsoft Corp. to succeed DOS as the standard operating system on 80286- and 80386-based PCs. OS/2 Standard Edition 1.1, released in October 1988, adds a graphical user interface known as the Presentation Manager to the OS/2 kernel that came out in December of 1987. (See "The Truth About Presentation Manager," *PC Magazine*, April 11, 1989.) Both OS/2 1.0 and 1.1 are priced at \$325 and are sold by manufacturers of PC compatibles. For the same price, IBM sells Extended Edition versions of both OS/2 releases; these ver-

sions have been optimized for IBM equipment.

Presentation Manager programs have a look and feel virtually identical to those written for Microsoft Windows. This similarity will allow a near-seamless transition when users move from the DOS/Windows environment to OS/2. In addition, the Presentation Manager API (application program interface) is similar in structure (if not in detail) to Windows. Many of the first Presentation Manager programs to become available will be programs originally written for Windows.

Although it's taken almost 4 years for Windows to accumulate a critical mass of applications, the Presentation Manager is on a much faster track. Significantly, many software companies that had little interest in Windows have either released or are currently developing Presentation Manager programs. (See "Where the Apps Are and Where They're Going.") Among these companies are Borland International (with SideKick for Presentation Manager), Xerox (Ventura Publisher), Autodesk (AutoCAD), and WordPerfect Corp. (WordPerfect).

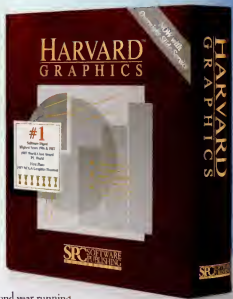
FACT FILE

OS/2 Standard Edition 1.1
Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073; (206) 882-8080. Available from several manufacturers of 80286 and 80386-based personal computers.
List Price: \$275 to \$399 (depending on manufacturer).
Requires: 80286 or 80386-based personal computer, 2MB RAM, hard disk with 8MB free disk space, graphics adapter.
In Short: OS/2 1.1 includes the Presentation Manager, a GUI similar to Windows but much more powerful. Application support for the Presentation Manager is already impressive. Upcoming releases will include a better shell, convergence with Windows, and full support for 32-bit registers and addressing available on the 80386 chip.

CIRCLE 409 ON READER SERVICE CARD

OS/2 and the Presentation Manager provide programmers with a more robust environment than that available under DOS and Windows. OS/2 uses the protected-mode operation of 80286s to give programs access to memory beyond 640K and to implement preemptive multitasking. Many programmers find the Presentation

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Spreadsheet Rivalry Heats Up

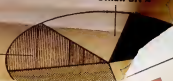
products are not enough if for
puter stores. not displayed in com

'Things are getting down and dirty,' a computer analyst observes.

Dealers who have seen what will be
...red bu ... w pr

The Spreadsheet Market

OTHER 6.17



RACE OR VS. POSITION

just when it set-
tled in.

We Interrupt T War For This Im

To all those unlucky enough to be stuck smack in the middle of the current spreadsheet confusion, take heart.

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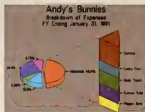
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1991	200.00	200.00	200.00	200.00	200.00
1992	200.00	200.00	200.00	200.00	200.00
1993	200.00	200.00	200.00	200.00	200.00
1994	200.00	200.00	200.00	200.00	200.00
1995	200.00	200.00	200.00	200.00	200.00
1996	200.00	200.00	200.00	200.00	200.00
1997	200.00	200.00	200.00	200.00	200.00
1998	200.00	200.00	200.00	200.00	200.00
1999	200.00	200.00	200.00	200.00	200.00
2000	200.00	200.00	200.00	200.00	200.00
2001	200.00	200.00	200.00	200.00	200.00
2002	200.00	200.00	200.00	200.00	200.00
2003	200.00	200.00	200.00	200.00	200.00
2004	200.00	200.00	200.00	200.00	200.00
2005	200.00	200.00	200.00	200.00	200.00
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2007	200.00	200.00	200.00	200.00	200.00
2008	200.00	200.00	200.00	200.00	200.00
2009	200.00	200.00	200.00	200.00	200.00
2010	200.00	200.00	200.00	200.00	200.00
2011	200.00	200.00	200.00	200.00	200.00
2012	200.00	200.00	200.00	200.00	200.00
2013	200.00	200.00	200.00	200.00	200.00
2014	200.00	200.00	200.00	200.00	200.00
2015	200.00	200.00	200.00	200.00	200.00
2016	200.00	200.00	200.00	200.00	200.00
2017	200.00	200.00	200.00	200.00	200.00
2018	200.00	200.00	200.00	200.00	200.00
2019	200.00	200.00	200.00	200.00	200.00
2020	200.00	200.00	200.00	200.00	200.00
2021	200.00	200.00	200.00	200.00	200.00
2022	200.00	200.00	200.00	200.00	200.00
2023	200.00	200.00	200.00	200.00	200.00
2024	200.00	200.00	200.00	200.00	200.00
2025	200.00	200.00	200.00	200.00	200.00
2026	200.00	200.00	200.00	200.00	200.00
2027	200.00	200.00	200.00	200.00	200.00
2028	200.00	200.00	200.00	200.00	200.00
2029	200.00	200.00	200.00	200.00	200.00
2030	200.00	200.00	200.00	200.00	200.00
2031	200.00	200.00	200.00	200.00	200.00
2032	200.00	200.00	200.00	200.00	200.00
2033	200.00	200.00	200.00	200.00	200.00
2034	200.00	200.00	200.00	200.00	200.00
2035	200.00	200.00	200.00	200.00	200.00
2036	200.00	200.00	200.00	200.00	200.00
2037	200.00	200.00	200.00	200.00	200.00
2038	200.00	200.00	200.00	200.00	200.00
2039	200.00	200.00	200.00	200.00	200.00
2040	200.00	200.00	200.00	200.00	200.00
2041	200.00	200.00	200.00	200.00	200.00

Link just about everything in sight

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January 28, 1989

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OFFICEVISION: Bringing PM to the Workgroup

by Bill Howard

OfficeVision stands as IBM's second major commitment to graphical user interfaces—the other one being, of course, the OS/2 Presentation Manager, one of the platforms under which OfficeVision will run.

What is OfficeVision?

For one thing, OfficeVision represents IBM's idea of how workgroups should function. Like the Presentation Manager, OfficeVision complies with SAA (Systems Application Architecture). IBM's grand applications scheme promises that applications will run under all of Big Blue's major computing platforms (OS/2, OS/400, VM, MVS); that they will be reasonably consistent across platforms in the areas of code, look and feel, and information manipulation; that they will use a graphical user interface to perform windowing, multitasking, and exchange interapplication information, as well as to support such alternative input devices as mice and touch-screens. OfficeVision is a big step on the way to fulfilling the promise of SAA.

OfficeVision is also a set of products. The first wave, called OfficeVision, Version 1, is due out this fall. It will include e-mail, an electronic Rolodex, a filer, a phone list with an auto-

dialer (which IBM calls "telephony"), and text processing. Version 2, slated for the first quarter of 1990, adds a calendar, a document library, decision support (graphics), and additional text-processing features. Every function is represented as a desktop icon. (Incidentally, instead of a trash can, Big Blue is going with a shredder.)

In addition to the OfficeVision core, IBM will offer an easy-to-use executive information system, will remarket or comarket third-party applications (Lotus 1-2-3/G, Metaphor's *Data Interpretation System*), and will extend a friendly welcome to third-party vendors who want to link in applications under SAA. More than a dozen had signed on when IBM announced OfficeVision on May 16.

SHARED DATA

Individually, many of the OfficeVision parts don't sound all that earthshaking. After all, IBM isn't the first company to offer LAN e-mail and auto-dialers. What IBM offers is the promise of a new level of integration and ease of use, its famous name, and the hope that it really will be possible to find, use, and share the information in all of your company's computers.

Consider this picture of workgroup computing, which OfficeVision should allow: You have an e-mail message from Martha Simpson on your iconic desktop and you want to talk to her. You drag the message over to the phone icon, and it dials Martha's number. OfficeVision knows how to reach her because you've got her name, her phone number, and her paper and e-mail addresses in an OfficeVision directory. Drag the memo to your Outbasket/HQ icon instead, and it's forwarded to your designated contact at headquarters, with a cover sheet if you want.

ON THE LAN

The OfficeVision/2 LAN Series, perhaps the most common way for PCs to take part in IBM's new system, costs \$750. Minicomputer and mainframe licenses cost up to \$51,000. There are also the costs of extra memory, upgrades to OS/2, LAN upgrades, the mandatory 8514 monitor for one application, etc. While there's no single set price for OfficeVision, IBM estimates a common configuration would cost \$7,500 per user. That's expensive, but if it unlocks greater productivity in the office, OfficeVision will be dirt cheap. ■

Manager API to be superior to the Windows API. In particular, the graphics system in Presentation Manager (called the Graphics Programming Interface, or GPI) is much better than the Windows GDI.

NEXT STOP: REPAIR SHOP

OS/2 and the Presentation Manager are relatively new and have several problems that must be fixed by Microsoft and IBM. Many of the more important fixes will show up in the next two OS/2 releases.

One of the weakest parts of OS/2 is the antiquated file system inherited from DOS. A new file system for OS/2 (called the High Performance File System, or HPFS) is promised for OS/2 1.2, to be released before the end of the year. HPFS will support long filenames (up to 256 characters) and extended attributes (which will allow ASCII or binary data to be asso-

OS/2 and Presentation Manager provide the user with a more robust environment than that available under DOS and Windows. The graphics system in PM is better than Windows' GDI.

ciated with a file via keywords similar to DOS environment strings). To take advantage of the new file system, you will have to reformat your hard disk. Of course, you won't have to do anything if you don't care about the new file system; it will be backwards compatible.

Also expected in OS/2 1.2 is a better Presentation Manager shell. The existing shell consists of a Task Manager, a Start Programs window, and a file-management program called File System. Although this is a sensible way to divide shell functionality, the Version 1.1 implementation is hopelessly confusing, unattractive, and not very graphical. The goal of the new shell is, of course, to give users an easy interface to manage files and start up applications. This may be facilitated somewhat by the new file system: one role of the new extended attributes is to identify the appli-



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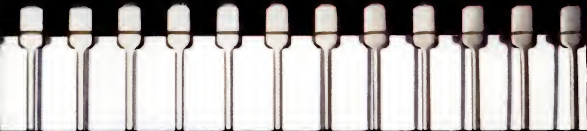
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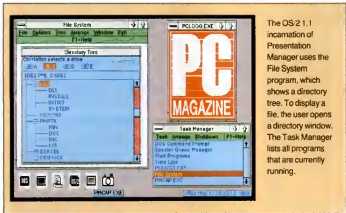
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The OS/2 1.1 incarnation of Presentation Manager uses the File System program, which shows a directory tree. To display a file, the user opens a directory window. The Task Manager lists all programs that are currently running.

cation that created a particular document file. This would allow a more object-oriented approach to file management and program starting. Eventually, the *Windows* shell and the Presentation Manager shell will be very similar.

POSTSCRIPT A PRIORITY

Current printer driver support for OS/2 1.1 is very weak; Hewlett-Packard Co., for instance, has not yet finished a driver for the LaserJet. These drivers are necessary for

Windows, but are more complex due to the increased responsibilities of the driver. One of the highest priorities is a driver for PostScript printers; this will very likely be included in OS/2 1.2.

Perhaps the most critical problem with OS/2 is its inability to take advantage of the 32-bit registers and addressing available on the 80386 microprocessor. The 80386 version of OS/2 (which will probably be called either OS/2 1.3 or OS/2 2.0) is scheduled for release sometime in 1990. It will support multiple DOS sessions, run existing OS/2 programs, and offer new applications a flat, nonsegmented, 32-bit address space.

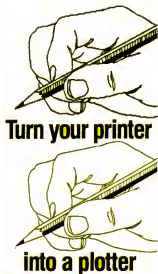
Another area of the Presentation Manager API that still needs work is font selection and generation. Although GPI supports scalable and transformable vector-based fonts (such as those in PostScript), these fonts have significant legibility and performance problems when used on the video display. Microsoft is working on these problems and plans to correct them; however, the details of these plans have not yet been revealed.

IBM and Microsoft intend OS/2 to be the dominant personal computer operating system of the 1990s. It is encouraging that they seem aware of the problems that could inhibit this development and are ready to fix them.

Of course, for users, the transition from DOS to OS/2 is a big move and will be justifiable only when an adequate collection of PM applications becomes available. It is likely to be 1991 or 1992 before most users even consider the move.

IBM and Microsoft intend OS/2 to be the dominant PC operating system of the 1990s—and they seem ready to fix any problems that could inhibit this goal.

Presentation Manager programs to display graphics on printers and plotters. Microsoft is pursuing several approaches to getting these drivers written and distributed. Presentation Manager device drivers are similar in concept to those in *Microsoft*



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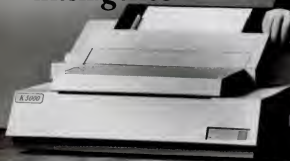
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The Macintosh Finder Pure GUI

by Philip F. H. Rose

The Apple Macintosh operating environment contains the purest manifestation of the GUI. Because the Mac's interface is integrated with its hardware, there are no obstacles to contaminate the interface. The Macintosh combines three elements to create its intuitive package: the Finder, a file-management program; the User Interface Toolbox, a set of developer's routines; and *HyperCard*, a complement to the existing user interface that extends its capabilities.

Like Microsoft, Apple has its own vision of the ultimate GUI. One part of that vision concerns the so-called human element. Most computer systems are designed primarily for processing, developed for cost efficiency, and, almost as an afterthought, tweaked to address ergonomic problems. Apple's emphasis, however, has always been on the human element in computer operation and has resulted in computers designed—from the bottom up—for ease of use.

VIRTUES OF AN INTERFACE

The second part of Apple's vision encompasses the three "cardinal interface virtues" that developers are mandated to strive for in a Macintosh application: responsiveness, permissiveness, and consistency.

Responsiveness means that the user must be able to execute tasks with the least number of steps possible. Apple's pull-down menu system—as contrasted with the command structure of such DOS applications as *Lotus 1-2-3*—is the best example of responsiveness.

Permissiveness refers to an environment that allows all reasonable commands to work instead of forcing the user into a con-

**What you've heard is true:
Macintosh's Finder is
indeed easy to use. But as
Apple's developers get
more innovative, will
Finder stay the same?**



stricting language. The DOS prompt, with its arcane terminology, is the classic non-permissive interface.

Consistency is the Macintosh's forte. When the standard elements of a program's interface work identically in all applications, users are rarely confused or irritated when they switch from one app to another.

AT THE CORE

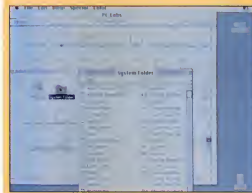
The core elements of the Macintosh's standard graphical user interface are the Finder and the User Interface Toolbox. The Finder is a file-management program comparable to the MS-DOS Executive in *Windows*—it's the first thing you meet when you boot up a Mac. The Finder presents files and disks with icons and windows; a menu bar lies across the top. Thanks largely to the Finder, initial familiarization with the Macintosh takes, at most, half an hour.

But beware: not everything on the Mac is perfectly intuitive. For example, you probably won't figure out on your own that you can eject floppy disks by throwing their icons into the trash. Even if you never learn that trick, however, you can still select the disk and choose Eject from the menus across the top of the screen. On a Mac, there's more than one way to open a file—or to perform just about any other operation.

Double-click on a data file, such as a document or spreadsheet, and the Finder will launch the application that created the data file and then load the file itself—a trick other GUIs have learned, too. On the Mac, all of this is done regardless of whether the originating application is visible on-screen; the Macintosh interface maintains a running directory listing the contents of every disk connected to the computer. And this facility extends further. As long as you do not "trash" the disk icon, the Macintosh will remember the contents of a diskette you've ejected from the system.

HIGH-IO FILES

Filenames may be up to 32 characters long on the Macintosh, rather than the restrictive 11-character (8 for the proper name, 3 for the extension) limit in DOS and the current version of OS/2-Presentation Manager. And while other environments will mark a file's size and its creation or modification date, the Macintosh also stores information about the application that created the file, the file's icon appearance, and



The Macintosh Finder interface includes the System Folder, which lists files and shows the object-oriented nature of each file type. The Finder can launch an application even if you can't see the application file on-screen; all you have to do is click on the associated document.

its type (worksheet, word processing document, database file, etc.).

The original Macintosh icons correspond to their functions quite well. The ubiquitous trash can, the file folder, and the text page are all easily understood at a glance. As newer applications in the Macintosh community have moved further from the original *MacPaint* and *MacWrite*, the purity of the interface has suffered a bit; many icons for third-party products depict nothing but the company logo or some other abstract image, suggesting nothing of the files' functions.

The other half of the Macintosh GUI is the User Interface Toolbox. This is where developers will find the standard routines to open a new file or create a text-entry window. As in any other complete GUI, the developer is left to concentrate only on the different and challenging aspects of the program, leaving all of the input/output work to the User Interface Toolbox.

The routines in the User Interface Toolbox offer a lot of power. The File dialog box, for example, allows you to browse through all of your directories and volumes without leaving the dialog box or the initial command. Most of the Macintosh's User Interface Toolbox is in ROM and is closely integrated with the system for speed and consistency. While this means that minor changes to the User Interface Toolbox cannot be applied to existing Macintosh ROMs without replacing them, software patches can be applied in RAM to keep existing machines up to date. The Macintosh's operating system accommodates such patches with very little disruption.

The graphics system for the Macintosh

is called QuickDraw. It lies underneath the various resource managers that handle windows and menus. Because of the placement of the QuickDraw graphics routines in ROM, the Macintosh's graphical interface moves right along, even on the older Macintosh PCs with 68000 processors and only 512K or 1MB of RAM. QuickDraw contains routines that work within a window or a region of a window, using local coordinates without the risk of affecting anything outside of the window. With the added help of the Window Manager, which also keeps track of overlapping windows, the Macintosh handles window presentation with speed and efficiency.

THE SOUND OF MUSIC

When looking at a Mac, it's important to remember the role that hardware plays in creating a robust, friendly user environment. Sound is a good example. From the very first 128K Mac, the system has included a four-voice synthesizer. Both voice and music can be played through the Macintosh's internal speaker or through a jack to external speakers. The Mac II adds support of MIDI (Musical Instrument Digital Interface), the industry-standard protocol for communication among synthesizers. With a Mac, a business user can add sound to make presentations snappier.

While the Macintosh operating environment has changed significantly over the years, its appearance and "feel" have remained simple and predictable. This has been one of its biggest selling points, both in corporate and personal markets, and a focal point of Apple's advertising cam-

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GUIs WITHOUT GRAPHICS

by M. David Stone

Still not convinced that GUIs are the way to go? Or maybe you think they're fine for the future, when fast 386-based systems and good VGA monitors will be cheap, but right now you're still using XT's and early, slow AT's equipped with IBM monochrome adapters. Or maybe you're convinced in principle but are waiting for more GUI-based applications.

If any of these considerations applies, you might want to try Brightbill-Roberts & Co.'s *HyperPad*, which is priced at \$99.95, or Quarterdeck Office Systems' *DESQview*, which costs \$189.90 for the 386-based version. Both character-based products will work at acceptable speeds on DOS machines. Both offer features associated with a graphical user interface. In effect, they give you a GUI without bitmapped graphics, though each one offers a different set of GUI-like features.

If you're attracted primarily to the ease of use that GUIs offer, you're likely to be interested in *HyperPad*, which is partly a development tool. As with *HyperCard* on the Macintosh, you can use *HyperPad* to create databases, then link the data together in any way you like. More interesting is that the program lets you use the same linking tools to create a GUI-like DOS shell.

WINDOWS LOOK-ALIKE

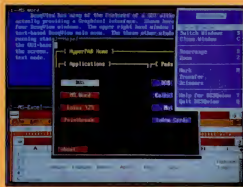
In appearance *HyperPad* is uncannily like *Microsoft Windows*, complete with pop-up pull-down menus, dialog boxes, and nonmnemonic SAA menu choices. Although the program runs in text mode and can run on an IBM monochrome adapter, it takes advantage of color- and character-based graphics to offer as graphical a look as possible without bitmapped graphics.

HyperPad is also similar to *Windows* in its use of a keyboard and mouse—so much so that once you're comfortable using *HyperPad*, you'll have hardly any learning curve if you eventually move on to *Windows* or *Presentation Manager*.

Interestingly, *HyperPad* goes beyond *Windows* in at least one respect,



HyperPad uses color and text-based graphics to achieve a look similar to a GUI's. The Home Pad lets you move to other pads or applications. The Install Pad allows you to create buttons to call up such applications as *Microsoft Word*, *Lotus 1-2-3*, and *PC Paintbrush*.



DESQview offers many features associated with GUIs, but it doesn't run in graphics mode. Like *Microsoft Windows*, *DESQview* lets you run several programs at once. It can even run *HyperPad*, another nongraphics product with GUI capabilities.

by letting you create on-screen "buttons" to run programs, batch files, or DOS commands. You can invoke a button by a point-and-shoot strategy, using either the mouse or the keyboard. When invoking a program, *HyperPad* releases all but 2K of RAM.

HyperPad comes with a prewritten DOS shell that is functionally similar to *Xtree* or *The Norton Commander*. Because you can add buttons, delete them, or move them around, you can customize the shell easily. For example, you might want to remove the Delete button to guard against mistakes by less-experienced users. Or, you might want to program complex batch-file operations

onto buttons for simple push-button computing.

THE FUNCTIONAL EQUIVALENT

If you're more interested in functionality than in ease of use, take a look at *DESQview*. The *DESQview* operating environment is the functional equivalent of *Microsoft Windows* in many ways. It will let you run several programs at once, switch among them at will, and display each in its own full-screen or partial-screen window. It will also let you change the size, position, and colors for each window—even letting you add color for programs that normally run in black and white.

DESQview comes in two flavors: plain vanilla, priced at \$129.95, which runs on any IBM-compatible PC; and *DESQview 386*, priced at \$189.90, for 386-based systems. The *DESQview 386* program includes a memory manager, *QEMM-386*, which lets *DESQview* take advantage of 80386-specific features to give you multitasking and windowing capability with virtually all of the programs you have. Quarterdeck also sells *QEMM-386* separately for \$59.95.

Like any good GUI, *DESQview* is equally well designed for mouse or keyboard. You can use either one to switch between windows, resize windows, or choose from the pop-up *DESQview* menus. The mouse-cursor movement is a little jerky because the screen is in text mode, but not bad enough to be annoying.

In addition to its multitasking and windowing features, *DESQview* offers several utility functions that tie together programs in a GUI-like way. For example, in the equivalent to a clipboard function, you can read ASCII data from any text window and transfer it to any other window.

WINDOWS-WIDE MACROS

A built-in macro feature not only provides macros for any program that doesn't already have them but has the added benefit of letting you write macros that work across windows. For example, while writing a letter, you could invoke a macro that would go to a window with a database program, find a record, read the name and address from the window with the database, and copy it into the letter you are writing.

Of particular interest if you're using both text-based and graphics-based applications is that *DESQview* can run both and can show both on the screen simultaneously. It can even run *Microsoft Windows* (using *Win86.COM*, the equivalent of *QEMM-386*) and *GEM* in *DESQview* windows. This means, for example, that you can run *Microsoft Excel* in one window while running *WordPerfect* in another. By using *Microsoft Windows*, you can also run several *Windows* programs in a single *DESQview* window, though Quarter-

PC FACT FILE

HyperPad, Version 1.0
Brightbit-Roberts & Co., 120 E. Washington St., #421, Syracuse, NY 13202; (315) 474-3400.
List Price: \$99.95
Requirements: 384K free RAM; DOS 2.1 or later.

In Short: If you're still determined to stay in character mode but want to reap the ease-of-use benefits of a graphical user interface, give *HyperPad* a try. Like the Apple Macintosh's *HyperCard*, *HyperPad* lets you create databases, linking the data any way you like.

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Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405; (213) 392-9851.

DESQview, Version 2.25
Price: \$129.95
Requirements: 640K; DOS 2.0 or later.

CIRCLE 429 ON READER SERVICE CARD

DESQview 386
List Price: \$189.90
(includes *QEMM-386*).

Requirements: 1MB RAM; DOS 2.0 or later; 80386-based personal computer.
In Short: The functional equivalent of *Microsoft Windows*, this character-based environment will let you run several programs at once, switch among them at will, and display each in its own full-screen or partial-screen window. The *DESQview* program promises to be a solid bridge between today's character-based reality and tomorrow's GUI.

CIRCLE 346 ON READER SERVICE CARD

deck recommends running only one *Windows* program per window and loading *Windows* separately in each *DESQview* window.

DESQview's ability to work with most current software makes it a solid bridge between today's character-based reality and tomorrow's GUI. At some time in the future, if you find that all your *DESQview* windows are running *Windows* programs, you'll be able to shift painlessly to *Windows*—or to *Presentation Manager*, without having to learn anything new at all. ■

paings. Apple's May announcement of *System 7.0* suggests that the company will continue to respect the consistency of the interface.

THE SAME BUT BETTER

System 7.0 is a collection of enhancements that improve the Macintosh environment substantially without significantly altering the existing interface. At the forefront are improvements in multitasking, remote database access, memory handling, and text manipulation. The new *InterApplication Communication Architecture* meets or exceeds OS/2's interprocess communications, allowing applications to exchange both data and instructions. Database improvements will allow users to integrate remote host computer databases into the standard interface, so that users with no knowledge of the remote system will be able to work with the databases by using standard Macintosh techniques.

Also included in the new release will be tweaks to the *Finder*, including context-sensitive help and a file-finder utility. More importantly, a new collection of *Finder* features will give the user more control over the appearance of the desktop. The *Finder* has also been made more extensible to accommodate future enhancements like fax and backup. Other improvements include sound sequencing and multimedia presentation capabilities, new communications tools, and 32-bit *QuickDraw*, which opens up color displays to 16 million colors on-screen simultaneously.

It may be a while before users see *System 7.0*; developer kits should be out this fall, but at press time, Apple wasn't saying when end-user products would be available. Apple's plans, however, are encouraging in that *System 7.0* seems faithful to the existing Macintosh GUI.

HyperCard, however, is less faithful to the *Finder* and gives cause for some alarm as well as enthusiasm. Introduced in the fall of 1987, *HyperCard* is currently slated not to replace the original interface, but to complement it. Indeed, *HyperCard* has both improved and confused the Macintosh world.

Bill Atkinson, the creator of *MacPaint*, developed *HyperCard*. Like *MacPaint*, *HyperCard* does not follow some of Apple's carefully delineated guidelines. For example, in order to launch an application in *HyperCard*, you click on it just once with the mouse, not twice. You have to switch to a different mode if you want to drag things around. More importantly, on

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COVER STORY

GRAPHICAL USER INTERFACES

a Mac Plus or Mac SE with a standard 9-inch screen, *HyperCard* (like *MacPaint*) takes over the entire screen, without using any windows. While Atkinson's theories about GUIs may be as good as Apple's, the problem is that they are different.

STACKING THE DECK

HyperCard sets a new standard for what you can do with a PC and what you should expect from it. With elements of database management, object-oriented programming, hypertext, personal information management, paint programs, and GUIs, *HyperCard* is a wonder that more than satisfies Apple's first two criteria: responsiveness and permissiveness.

HyperCard's operative metaphor is an innocent-looking stack of index cards. Each card (screen) consists of graphics, text fields, and buttons. Clicking on a button initiates a script (or program) that may jump to another card or that may be as complex as programs written in third-generation languages such as C and BASIC.

HyperCard is very flexible; you can write scripts—to create, for example, a button that jumps to other cards or fields to store information—without writing a line of code. Later, you can touch up what was generated automatically. Nonprogrammers may find themselves capable of creating new stacks at an astonishing rate.

PC users can expect to see *HyperCard*-like capabilities soon. *HyperPad* (see "GUIs Without Graphics") is a start, but more-powerful packages are on the way.

HACKER'S PARADISE

The dream is that *HyperCard*'s mass availability (it is given away free as system software) and ease of use will result in thousands of worthwhile programs out in the ether, free for the taking—a digital community sharing programs that solve problems, entertain, and inform. Even if the reality falls short of this dream, *HyperCard*'s future is bright.

John Sculley's nonspecific comments suggesting a closer link between *HyperCard* and the Macintosh's standard graphical user interface are both worrisome and exciting. If the Macintosh interface changes too much, it may jeopardize the base of consistency already established. On the other hand, it would be a shame to lose *HyperCard*'s multimedia power. The challenge facing Apple is to allow innovation without sacrificing consistency.

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Faces of Unix

by Ross M. Greenberg

Unix is both the least likely and the most likely candidate for a graphical user interface—least likely because the very idea of a GUI is foreign to the Unix ethos, and most likely because, without a GUI, Unix will not fly in the mainstream corporate marketplace.

First developed at the Bell Labs about 20 years ago—several years before the GUI was invented at Xerox's PARC—and licensed (with source code) to universities and companies, Unix is the archetypal command-line environment. With commands like `pwd`, `awk`, `grep`, and `noff` (and you thought `DIR` and `DEL` were cryptic!), Unix has often been considered an operating system that only an engineer—or a graduate student—could love.

The simple command-line interface is ideal for the traditional Unix configuration—a centralized mainframe or minicomputer servicing multiple users on dumb terminals—but isn't likely to win over corporate America in the 1990s.

DESPERATELY SEEKING A GUI

Almost everyone agrees that a GUI is what Unix needs most to ensure its survival and competitiveness among corporate users. The question is not whether Unix will have a GUI, but *which* GUI it will be. Until now, you had to decide which of the dozen variants of Unix was best for your shop before you could choose a GUI. With the return of AT&T to the Unix driver's seat, most of Unix's many models are starting to be merged into the long-awaited Standard Unix.

Long considered an operating system only an engineer could love, Unix will need a friendlier interface to woo corporate America.



COVER STORY

GRAPHICAL USER INTERFACES

Several of the contending Unix GUIs are based on the Unix X-Windows system, developed at MIT in 1984. X-Windows is currently in Version 11 and is commonly referred to as "X11." In the tradition of Unix's open heritage, the X-Windows definition has been released to the public domain.

The big advantage of the X-Windows system over DOS- and OS/2-based graphical user interfaces is its network transparency. In keeping with the traditional Unix configuration of central machines and terminals, you do not need to run an X11 application entirely on your PC or workstation to use it. In X-Windows terminology, the application runs on a "client," which could be another, more powerful machine on the network. The program displays graphical output and receives user input from the "server"—the machine you happen to be sitting at. Your local machine can display several different X11 programs running simultaneously on several different clients.

CHOOSING A STYLE

X-Windows is a windowing environment, not a GUI. It does not define a style—the way a window appears on the screen or how windows respond to user input. The majority of GUIs running on Unix actually run on top of X, using their own styles or adhering to some standard style guide that is usually implemented through a unique set of APIs.

To prevent programmers from constantly reinventing the wheel, a collection of X protocol routines was created. This library is an easy API to the underlying X protocol. However, it still does not fully define the sought-after style of a GUI.

Enter XUL, the programming interface for DEC's *DECWindows* implementation of X. XUL does define a style and provides a reasonable collection of tools—called *widgets* and *gadgets*—that make the programmer's life a bit easier. A developer can use this extensive library of routines to define what a window will look like and how it will react to events such as mouse movement or keyboard input.

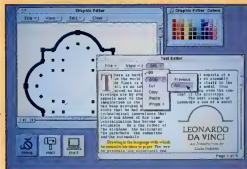
But even XUL isn't a GUI—it doesn't demand the kind of consistency that makes applications retain the same look and feel.

THE POWER OF SUN

Sun Microsystems, the newly risen star of the engineering workstation market, has done a lot of work to establish a consistent look and feel for Unix.



NeWS, Sun Microsystems' original graphical user interface, extends the PostScript language to networking applications. The XView toolkit lets developers port their NeWS applications to Sun's new GUI, Sun/Open Windows.



Sun/Open Windows is the latest graphical user interface from Sun Microsystems. It can run on top of X11/NeWS, XView, or Open Look, which was developed by AT&T and Sun in their joint efforts to merge AT&T's Unix with the Berkeley version.

Sun's original display manager for Unix is known as NeWS (for *Network-extensible Windowing System*), which extends the PostScript language for video displays to networking applications. There are currently just under 100 licensees of NeWS, busily porting NeWS to Unix and non-Unix environments alike. There is already at least one port of NeWS available under OS/2; it allows for multiple sessions in OS/2 to redirect their output to a NeWS window, where the output is "transformed" into NeWS commands, then interpreted and displayed. NeWS is a very powerful system: programs such as Charles Petzold's infamous OS/2-Presentation Manager-based BOXES can be implemented directly with only about 10 or 15 lines of indecipherable NeWS code. (NeWS code is often fondly referred to as "write-only" code.)

The NeWS approach is slightly different

from that of other GUIs: NeWS allows the window itself to become "intelligent." It also allows the intelligence to be modified remotely by the application program—the functionality of a button, for example, can be changed by sending the intelligent window new instructions.

Is this the long-awaited distributed processing? Well, sort of. The application program is still in control and must delegate responsibilities to the remotely connected server(s). However, the throughput on the network channel is substantially reduced because the local application can simply wait for the final message of an operation to be passed back on the channel by the remote intelligent window. Under plain X, for example, the local application would have to interpret each "event," including such mundane things as simple mouse movements within an application's window.

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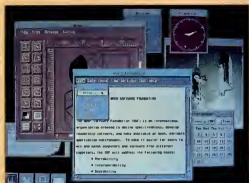


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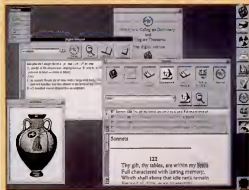
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OSF/Motif, which looks and feels like the Presentation Manager, is the GUI defined by the Open Software Foundation. The OSF was formed by such giants as IBM, DEC, and Hewlett-Packard to counter the alliance between AT&T and Sun.



NeXTStep is the windowing system for the NeXT computer. Currently a monochrome system, the NeXT computer sports a high-resolution monitor that shows impressive views of NeXTStep, which adds a 3-D style to the usual stock of GUI features.

JOINING FORCES

In the spring of 1987, Sun and AT&T joined forces to create a new Unix that would merge AT&T's Unix with the Berkeley strain and would include a graphical user interface called *Open Look*. Like the interface on Sun's X11/NeWS workstations, *Open Look* ties together the network transparency of X with the low throughput requirements of NeWS and adds a consistent style, making it a real GUI.

Open Look, which was recently renamed *Sun/Open Windows* by Sun, has a pretty nice appearance. It comes with its own set of widgets and gadgets and its own style guide. The underlying technology, either X11 or X11/NeWS, will be standard in AT&T's next Unix version, System V, Release 4.0. As a migration path from Sun's current graphical user interface, Sun has offered its 1,000 developers a simple means of porting their 2,100 applications

over to *Open Look* by releasing the *XView* toolkit (based on its *SunView* toolkit). *XView* has also been released to MIT, the keeper of the X protocol.

Although many end users are delighted to see AT&T and Sun—and with them, the two main flavors of Unix—come together, the original equipment manufacturer (OEM) community finds *Open Look* pretty closed. To Sun's competitors, AT&T's alliance with Sun gives the workstation vendor an unfair advantage: Sun's SPARCstations, they fear, will bring the new-and-improved Unix to market before anyone else.

STRANGE BEDFELLOWS

Heavyweights such as IBM, DEC, the Santa Cruz Operation (SCO), and Hewlett-Packard reacted by putting together their own power alliance, the Open Software Foundation. The OSF's agenda is to

create its own version of Unix, which will be based largely on IBM's AIX. The group has already defined the interface portion of its Unix. The style of this interface, *OSF/Motif*, is based on Microsoft's Presentation Manager.

Although the *OSF/Motif* definition does not include PM's API—X-Windows supplies the API layer—it does offer a simple and consistent interface across OS/2 and Unix applications. Of course, some things will be different under *OSF/Motif*: which way is better or more intuitive will be up to the end user to decide and to the application programmer to implement. Although OSF and a competing organization called Unix International have both made it difficult for end-user viewpoints to be heard, end-user dollars will ultimately decide which GUI will grace Unix.

PM FOR UNIX

Microsoft, SCO, and HP are expected to deliver a version of the Presentation Manager for Unix that includes the full API of PM, including the Graphics Programming Interface (GPI). Programs that don't make any OS/2 kernel calls (and which thereby stay totally within the realm of the C runtime library except for display calls via OS/2's PM) will be portable, with little or no modification, over to the PMIX environment.

According to Microsoft, the majority of the PM code is written directly in assembly language, restricting the first "simple" port to the same architecture. By the end of next year, versions of OS/2 and its attendant GUI will be written in a more transportable language, thereby allowing the newly ported PMIX product to also exist on other architectures.

PMIX will permit PM to exist on (initially) 386 platforms operating under Unix. Take a look at this vision of the future: the PMIX user could have access to a NeWS window, an X window, various PM applications running under PMIX, Unix's extensive networking capabilities, and communications with OS/2 LAN Manager workstations.

WHAT'S NEXT

Another non-X11 Unix GUI of the future has appeared on the NeXT computer from Apple cofounder Steven Jobs's Palo Alto-based company. The NeXT computer's *NeXTStep* windowing system has been licensed by none other than IBM. Big Blue has demonstrated *NeXTStep* running under AIX on its RISC-based RT-PC; however,

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CIRCLE 311 ON READER SERVICE CARD

BEYOND THE GUI: Wang Freestyle

by Charles Petzold

After a few minutes of working with The Wang Freestyle System, you'll realize what's wrong with *Microsoft Windows* and the Presentation Manager. *Windows* and PM simply don't go far enough. They aren't real GUIs because they're still locked into character-mode forms of interaction. They haven't extended the object-oriented paradigm to documents and their applications. They're still in GUI infancy, and they have a long way to go.

Freestyle is a DOS application program that is intended to automate forms of office communication that have been neglected in more traditional forms of office automation—such as handwritten notes, marked-up documents, telephone messages, and spoken discussions.

The *Freestyle* system is both hardware and software. For \$1,995, the basic package includes a special tablet and stylus, plus an interface card and software, all specifically designed for *Freestyle*. If you don't use Wang's 100-dot-per-inch 1,024-by-1,024 monochrome video board and monitor (priced at \$3,910), you'll need to get a monochrome Hercules graphics card. Other options include a voice interface and handset (\$1,495), fax board (\$1,595), printer (\$2,969), scanner (\$2,550), and network (\$100 per client for interface software).



FACT FILE

The Wang Freestyle System, 1.0
Wang Laboratories Inc., One Industrial Ave.,
Lowell, MA 01851; (800) 522-9264.
List Price: Tablet, interface card, pencil, and
software, \$1,995; voice interface with
handset, \$1,495; fax interface, \$1,595; Wang
high-resolution monitor, \$3,910; standard-
resolution software, \$150; *Freestyle* SC300
scanner, \$2,550; LDP 8 local printer, \$2,969.
Requires: 640K RAM for standard-
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monitor; 80286- or 80386-based compatible;
Hercules-compatible graphics adapter or
high-resolution video card; Hercules-
compatible monitor or Wang high-resolution
monitor; DOS 3.2 or 3.3.

CIRCLE 427 ON READER SERVICE CARD

OFFICE ICONS

The Wang Desktop contains icons representing office equipment—in box, trash can, printer, fax machine, copy machine, pads of paper, folders, file cabinet, stapler, and unstapler. All of these icons are manipulatable using the tablet and pen, which in *Freestyle* takes the place of a mouse (and, as we'll see, is more versatile). You can set up your Desktop any way you want, choosing icons from an icon catalog and placing them where you will.

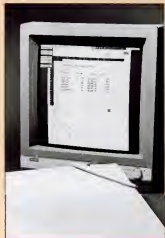
You'll notice several icons on the Desktop that resemble little sheets of paper. These are *Freestyle* "pages," the basic system objects. A page begins life as a DOS screen capture, a fax transmission, a scanned image, or simply a blank (or lined) page from an on-screen pad. (A page can also be created from an image on *WITS*, the Wang Integrated Image System.)

When you select the page with the tablet pen, it enlarges to full size on the Annotator screen. As the name implies, this screen allows you to annotate the page. You use the keyboard to make typewritten additions to the page, the tablet and pen to make free-form written comments or sketches, and even a telephone-like device (and a tape recorder console in the upper-right-hand corner of the screen) to add voice annotation. If you want to erase some of your handwritten annotations, you simply turn the pen around and erase them!

Back in the Desktop screen, you can store these pages in folders, staple them together to form documents, copy them, print them on a local or remote printer, fax them, or send them as mail over the network. Just drag the page to the appropriate icon!

SPEAKING IN SYNC

If the page contains voice annotations and you send it to someone over the network, the recipient can "play back" the page. The typewritten comments, handwriting, and voice information are all synchronized during the playback. If you say "Verify this number" at the same time that you circled a number,



Wang Freestyle, a hardware/software DOS-based system, includes a tablet and stylus, which lets you attach handwritten notes to files.



The Wang Desktop displays files as miniature pages and commands as icons. A page dragged to the copy-machine icon duplicates the file.

the recipient will see the number being circled in synchronization with your voice. The recipient can then make additional annotations ("That number is correct") and send the document back.

What's amazing about this system is how absurdly easy it is to use. Almost every operation I've described can be performed without touching the keyboard. For example, to print a page, you simply move the page icon to the printer icon using the tablet pen. To put a page in a folder, you move it to the folder. The pages (which are actually

stored on the hard disk in a modified TIFF format) don't even have names. The folders themselves can be labeled any way you want using either the keyboard or the pen.

There are certainly limitations in *Freestyle*. What it does it does well, but it doesn't do much beyond what I've described here. In its current incarnation, *Freestyle* doesn't attempt any handwriting or voice recognition. And even if a page is initially created from a DOS screen capture that contains ASCII text, you can't later extract this ASCII data from the page. The "typewriter" facility in *Freestyle* performs word wrap, but it's not a word processor.

LOGICAL ELEGANCE

Yet, the easy manipulation of objects in Desktop shows just how beautifully elegant a graphical user interface can be when carried to its logical extremes. The combination of various data types (ASCII, handwriting, voice) in a single page demonstrates how convenient computing can be when attention is focused on the task rather than the tools.

Of course, it's quite unfair for me to ask why *Windows* and the Presentation Manager can't be as easy to use as *Freestyle*. *Freestyle* is an application, not an operating system. It doesn't have to support a myriad of complex applications such as word processors or spreadsheets. The ability to print a document by dragging the document icon to the printer icon is simple and elegant, yet I realize that supporting something like this in the Presentation Manager has profound programming implications in both the operating system and the applications.

But after a session with *Freestyle*, the Presentation Manager cannot help but seem primitive, simplistic, and already outdated. I know how much good stuff has been built into PM, so it pains me to say this. It's obvious, though: There is still much work to be done to extend the Presentation Manager into a truly object-oriented environment.

I want to see it happen. When I was working with *Freestyle* in PC Labs, a couple of people walked by and asked me if this was the Presentation Manager. I wish I could have said that it was. ■

it has made no commitment to actually selling it.

The NeXT computer has proved an elusive beast to evaluate: although commercially available to educational institutions, there are no evaluation units around. The folks at NeXT consider the current version a beta release unsuitable for evaluation purposes.

The NeXT computer includes the MACH operating system (which is a virtual Unix clone), the BSD 4.3 utilities, Display PostScript, the NeXTStep window server, the Workplace Manager (the windows control program), and a variety of tools to aid in completing NeXTStep/Display PostScript applications.

The resolution on the NeXT computer is high, and the images of the GUI glimpsed so far are impressive. Looking very much like other GUIs, NeXTStep adds an enhanced 3-D look and feel, albeit only in gray scale for the time being. NeXTStep promises to impress—especially in combination with other NeXT computer standard features—including such non-graphics-based concepts as a MIDI interface, a sound subsystem comparable to the Amiga's, and a huge optical disk you're unlikely to outgrow. Furthermore, you'll even be able to use the optical disk for some full-motion color video, and you'll be able to edit the soundtrack. This spiffy next-generation stuff is just over the horizon.

SLOW BUT SURE

So should you run out and buy one of these Unix GUIs? That may not be possible just yet. Not all of them are shrink-wrapped and waiting for you. Based on how your needs are met by the current Unix GUIs, you may have to hold off on buying the ultimate Unix GUI until it's available.

Like most things in the Unix community, the movement to graphical user interfaces has been slow when compared with newer operating systems recently arrived on the multitasking scene. That's probably a wise course of action, considering Unix's huge installed base (some estimate that 65,000 new Unix sites come alive each month!). Add in the Unix wars raging between AT&T and Sun and the forces of the OSF, and such careful maneuvering can be understood. But the sleeping giant of the Unix user community has awakened and is already beginning to embrace the concept of a GUI. ■

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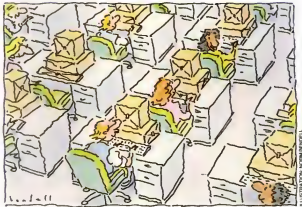
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286s

No Frills, Few Thrills



It's no secret that *PC Magazine* wholeheartedly endorses the 386-based PC as the standard machine for business computing. The 32-bit operation and memory-handling capabilities of 386-based PCs make them far superior to 286-based systems, and Intel's aggressive January price drop for the 386SX chip virtually guarantees that the 386SX will someday replace the 286 as the entry-level business system.

At present, however, 286-based machines still dominate the PC market. The 386 may constitute the fast-

est-growing market segment, but the 286 is still the biggest seller and probably will be for some time.

Why? The answer is price. For VGA systems, the average standard-configuration price of a 16-MHz 386 machine is about \$1,300 over the average standard-configuration price of a 12-MHz 286 PC: \$4,550 versus \$3,250 (based on figures from this roundup and those in the January 31 and May 30, 1989, issues of *PC Magazine*).

A 386-minded consultant might point out that after factoring in a 5-

by Mitt Jones

**We still say you should buy a 386,
but if the budget says no, these 21 12-MHz
286s deliver passable performance
for about \$500 less than a 386SX.**

year depreciation and the corresponding tax savings, the additional cost of a 386 machine seems trivial and is more than justified by the increase in employee productivity. For individual consumers and corporations alike, however, depreciation and tax savings don't mean much when a PC is needed and \$2,500 is all the budget will allow. A 12-MHz 286 runs *WordPerfect*, *OS/2*, and *PageMaker* far better than a steno pad and No. 2 pencil can.

Intel, Microsoft, and others promise that buying a 386 will pay off in the long run, even for mundane computing chores: 32-bit OS/2 Presentation Manager applications will bring such great innovations and productivity gains that anyone who does not join the party will be left out in the rain. Even if you share at least some faith in this happy vision of tomorrow-computing, you must still grapple with the question of how far in the future its fulfillment lies. Will any machine you buy now still be gasping along by the time this new world arrives?

286 KILLER

In theory, the 386SX—Intel's 286 killer—makes the timing a moot issue. Though boasting all the functionality of the 386, including 32-bit internal operation, the 16-MHz 386SX communicates with the remainder of the system via a 16-bit bus, just like the 286. Manufacturers therefore should be able to produce a 386SX-based machine as cheaply as a 286 machine of the same speed. The price differential between a 286/12 and a 16-MHz 386SX should be \$500 at most.

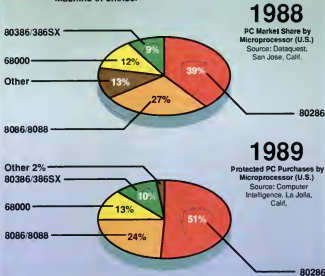
That hasn't happened yet, at least not

Some vendors continue to introduce new 286 machines; others let them rest in peace.

on a large scale, primarily because of the limited supply and original high price of the 386SX chip. In January, Intel lowered the SX bulk price from the original \$165 to \$89 per chip in quantities of 1,000. (Typically, 12-MHz 286 chips cost \$20 to \$30 each in like quantities, while 16-MHz 286 chips sell for \$60 to \$80.) Intel has also stepped up production of its SX chips.

286s: ON TOP FOR NOW

Among corporate, education, and government PC users, the 80286-based system is currently the machine of choice.



These moves have prompted several vendors, including Compaq, to reduce the prices of their 386SX machines. At least one vendor—Club AT—has announced a base-configuration 386SX machine at a price below \$2,000. The trend can only continue.

Do lower SX prices augur the death of the 286? Yes—maybe. The 386SX will kill off anything within a few hundred dollars of its price range. 16-MHz and 20-MHz 286 machines, which require components just as expensive as those of a 16-MHz 386SX, will die a quick death.

The 286/12 stands a chance, but just barely. Any cost incentive the 286/12 can legitimately claim results from its slower, less expensive DRAM and its less expensive processor. Assuming that DRAM and the 386SX chip itself continue to fall in price, the 286/12 cost incentive will continue to dwindle.

Of course, the will of PC vendors also affects pricing and availability. Some vendors, like Compaq, continue to introduce new 286 machines and lower 286 prices. Other vendors seem content to let the 286

rest in peace. Advanced Logic Research recently began shipping a 386SX priced at \$1,795, the same price as its 12.5-MHz 286. It subsequently discontinued the 286 rather than lowering its pricetag. Whether the move resulted from a real concern for the buyers' best interests, the desire to be viewed as a forward-looking company, pressure from Intel, or a combination of these, the end result is the same.

THE BOTTOM LINE

What does it all mean? It's simple: whether or not you share Intel's vision of a 386/386SX world, there will be a time, soon, when pricing and present-day performance alone will justify acceptance of the 386SX as the entry-level business machine. It may not happen overnight, but it will happen. In the meantime, the 286/12 remains an attractive entry-level option—if you're prepared to live with its limitations for years to come.

If money is no object, buy a full-powered 386-based machine. If you can't stomach 386 prices, try a 386SX. By the time this issue hits the newsstands, you

Whether you're agonizing over the 286-versus-386 issue or simply trying to decide which 286 to buy, upgrade considerations should play a major role in your purchasing decision. Just how far into the future a 286 machine will take you depends on which machine you buy and how much money you're willing to pour into it later.

First, even if you're banking on the 286's ability to run OS/2 to carry you into the future, you'll need to plan on buying plenty of RAM. OS/2 requires a bare minimum of 2.5 megabytes, and you're much better off with 4.

That being the case, the maximum amount of RAM a system's motherboard will accommodate becomes important; while memory added through expansion cards is limited by the speed of the bus—8 MHz, or perhaps even 6 MHz—motherboard RAM flies along at a full 12 MHz, often with zero wait states. The amount of motherboard RAM may mean the difference between being able to live with your 12-MHz 286 or having to cough up the dough for a faster machine.

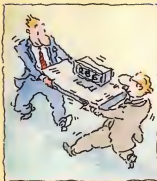
Another feature to look for is LIM 4.0 capability. The latest chip sets by Chips and Technologies, Suntac, and VLSI Technology have the memory-handling features necessary to implement LIM 4.0 fully, using all that extended memory on your motherboard.

Of course, when it comes to system upgrades, the number of drive bays and expansion slots always rates as an important consideration. Several of the machines in this roundup sacrifice a few slots and a drive bay or two for the sake of aesthetics or to conserve desktop space. Think seriously about what your future needs may be before you opt for one of these models.

What recourse will you have if you find you just can't live without a 386? The 386SX's 16-bit external data path,

HOW FAR CAN THEY GO?

by Mitt Jones



as well as its relatively low cost, makes it a natural for 286 upgrades, and several vendors have announced or are already shipping upgrade products based on the 386SX.

The Cumulus 80386SX card, which should be shipping by the time this issue makes it into print, promises to be among the most dependable and least expensive of the lot. With a list price of \$595, the card measures less than 3 square inches and plugs directly into the 286 socket, simply replacing the 286 with a 386SX microprocessor and effecting the necessary translation. Cumulus reports that it will support all three 286 socket standards: PGA, LCC, and PLCC. The company also plans to offer an adapter that accommodates an 80387SX math coprocessor. Everex is offering a similar, \$699 386SX daughtercard that works only with the Everex Step 286-12.

Neither of these cards will increase your system's clock speed or make standard applications run any faster;

though rated at 16 MHz, the 386SX can run only as fast as the system that drives it. What these cards will do is allow you to run all the software you could run on a 386, including *Windows/386* and *Paradox 386*.

Taking a slightly different approach, SOTA Technology promises a solution that will both replace the 286 with the 386SX and run the 386SX at a higher clock speed. The product, planned for fourth-quarter shipment, will comprise a 16-bit adapter with a 20-MHz 386SX processor and 16K static RAM cache (upgradable to 64K), according to SOTA. It will also contain a socket for the 80387SX. The PGA-socket version will retail for \$695, and the LCC/PLCC version will list at \$795. The company claims performance gains of 300 percent for an 8-MHz AT and 200 percent for a 12-MHz machine.

You might even opt for one of the 386 accelerator boards that have been on the market for a good while. Intel's popular Inboard 386/PC does not support 12-MHz 286 machines, but the \$1,799 PC-Elevator 386, by Applied Reasoning Corp., and the \$1,299 Jet 386, by Orchid Technology, do. Both run at 16 MHz, and both include 32-bit RAM to optimize performance.

Of the three basic approaches—a simple 386SX plug-in card, a 386SX accelerator, and a 386 accelerator—using a 386SX plug-in card should prove by far the most trouble-free. Just make sure the machine you buy has a socketed processor.

Does it make sense to buy a 286 now and add a 386SX adapter or 386 accelerator later? Not really. Even with one of the inexpensive adapters, you'll spend more on the 286 system and board together than you would have spent on a 386SX. If you're determined to buy a 286, however, rest assured that upgrade options are out there. ■

should be able to find a few attractive deals, and you'll buy with the security of knowing you're ready for whatever "killer apps" tomorrow has in store.

But if your decision is between buying a 286-based machine not buying at all, or if you honestly don't care about the wonderful applications the 386 promises

to inspire, then take the plunge. The 286 has been the mainstay of business computing for some time now, and the 386 and 386SX haven't caused it to run any slower.

A MATTER OF PRIORITY

Should you decide to buy a 12-MHz 286, your first item of business should be deter-

mining what's most important to you in a machine. How you rank the importance of several factors—compatibility, economy, speed, and service—will largely determine which machine you should buy. No one machine offers the best of all, but several provide good overall performance.

Compatibility involves much more

than simply which BIOS each machine uses. Some vendors write their own BIOSs, but most machines use either the AMI, Award, or Phoenix BIOS. While Phoenix enjoys the best reputation for compatibility, BIOS makers and large PC vendors alike have had plenty of time by now to fine-tune their code. Be it the Award, AMI, Compaq, or Everex BIOS, you shouldn't have to worry about BIOS incompatibilities.

Similarly, most of the machines we looked at here are based on one of a handful of 286 chip sets—from Chips and Technologies, Faraday (a subsidiary of Western Digital), Intel, Suntac, or VLSI Technologies. While no battery of tests can try compatibility as effectively as months of real-world use, all of the machines—including those based on the Suntac, a relative newcomer—performed flawlessly on PC Labs' tests.

The biggest area of uncertainty lies in the machines' compatibility with older expansion boards designed to work with PCs, XT's, or early AT's. One indicator is bus speed. If you intend to run older expansion cards, you should consider buying a machine that can run the bus at 6 MHz. Several of the machines build bus-speed switching into the turbo switch, which is primarily a processor speed control, or let you choose among two or three alternative bus speeds by setting DIP switches or jumpers on the motherboard. Such flexibility of control allows you to find the top speed at which your expansion cards will operate properly.

Expansion-card compatibility also involves more-complicated issues, such as how machines handle memory-refresh cycles. Compaq and a handful of other manufacturers have gone to great lengths to ensure compatibility with every expansion card ever to grace the bus of a PC, usually at the cost of performance. If you won't be moving old cards into your new machine, the performance sacrifices do nothing but slow you down.

At the opposite end of the spectrum, some of the fastest machines to make their way into this roundup were also the least expensive, built by assembly houses using low-cost, high-performance motherboards and brand-name components. The Destiny, MultiMicro, and Telemart machines fit this description, and each is based on the Suntac chip set. Will you have expansion-card compatibility problems with these machines? Probably not, but if it's that important to you, you should probably

look elsewhere or choose a machine with a 30-day money-back guarantee. Again, you must set your priorities.

Finally, a word about mail-order PCs. Some mail-order vendors, such as CompuAdd, Dell, and Northgate, have been around for so long and have earned such excellent reputations for quality and service that their machines are as safe a buy as anything. The machine components are the same, month after month, and the documentation, technical support, and service are tops.

On the other hand, there are bargain-basement assembly houses that build their PCs from whatever motherboard and name-brand components are cheapest that week and then ship the PC with documentation that is meager or altogether inaccurate. These machines deliver the best bang per buck around, and they will probably run just fine. But it's also likely that you'll spend inordinate amounts of time trying to decipher the documentation, get the cover of the flimsy case back on, or reach a technical support person to find out which jumper controls what. If you love to tinker with your PC, you'll love these machines. If you expect your PC to be a trouble-free servant rather than a hobby, go with a more established, more conventional vendor. The reviews in this issue, as well as those in the January 31, 1989, issue, should give you a good feel for what sort of quality, documentation, and service you can expect from each vendor.

THE LINEUP

This roundup encompasses a field of 21 of the latest desktop 12-MHz machines, including Compaq's new Deskpro 286c. For obvious reasons, machines we reviewed in the January 31 issue—including machines by Dell, Zeos, and others, as well as the Austin and Northgate Editor's Choices—are not reviewed here. But we have made every attempt to keep these machines in mind during the evaluation process. Some of the vendors we contacted, including Amstrad, Gateway 2000, and Twinhead, failed to send machines, although we contacted them well in advance of the deadline. Other manufacturers are not represented either because, like Tandy, they do not offer a 12-MHz machine, or because, like Zenith with its new Z-286 LP/12, they were not shipping at the time of our testing. As usual, we eliminated vendors who are active only as original equipment man-

ufacturers (OEMs) or who sell strictly to value-added resellers (VARs).

If there is an obvious common thread among the machines reviewed here aside from their speed, it is their size and appearance. Nearly every machine occupies less desktop space than the power-user AT's of old; and manufacturers seem to be acquiring a regard for aesthetics, if only because buyers are demanding nicer-looking PCs. However visually appealing the new chassis may be, the important question is to what extent these machines can be upgraded and how. We address that issue both in the individual reviews and in the sidebar "How Far Can They Go?"

As you examine the features table and reviews that follow, remember that in any purchasing decision no factor is more important than your own needs and preferences. Also keep in mind that the prices cited for each machine are suggested list prices. While mail-order vendors typically advertise a price and stick to it, other companies often list an inflated price and offer discounts to dealers and large accounts. The actual selling price can be 30 percent lower than the list, depending on the company and dealer.

ARCHE TECHNOLOGIES INC.

Arche Triumph 286

by Mitt Jones

About this time last year, the Arche Rival 286 got our attention—and an Editor's Choice—for its 2-year warranty, attractive small-footprint design, and overall quality and value ("The Niche Factor: Nine ATs Compete for Market Share," July 1988). With its latest 12-MHz entry, the Arche Triumph 286, Arche Technologies puts the same assets to work in a still smaller, faster, and less expensive package. The base configuration, which includes 512K RAM and monochrome monitor, carries a list price of \$1,495—\$300 less than the Arche Rival 286.

Based on Arche's own motherboard, which employs a VLSI Technologies chip set, a socketed Intel processor, and Phoenix ROM BIOS, the Triumph speeds along with zero wait states at 12 or 6 MHz, as selected from the keyboard. Our evaluation unit came with the motherboard's maximum of 1MB of 100-nanosecond 256-kilobit DIPs. Like most system manufacturers, Arche buys 100-ns. chips and

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runs burn-in tests on them to weed out those that won't run at zero wait states.

The I/O bus runs at 8 and 6 MHz, depending on processor speed. The Triumph's performance on certain PC Labs tests also indicates that the machine incorporates refresh cycles at 8 MHz to accommodate most older expansion boards.

The Triumph chassis measures a trim 4.25 by 16.25 by 15.75 inches (HWD)—not the lowest-profile machine reviewed here, but low nonetheless. The front panel provides front access to two half-height drives—one full-width and one 3½-inch. System controls comprise a keyboard lock and recessed reset button, as well as power, turbo, and disk-access indicators. The power switch is relegated to the rear panel of the chassis.

In stark contrast to the neat, almost vacant look of the Sunrise 286/12 (another low-profile machine reviewed in this roundup), the inside of the Triumph is disorienting when you first remove the system cover. Ribbon cables cross over from the drive controller, and everywhere you look you see more cables, unfamiliar brackets, and little free space. The components aren't difficult to reach once you've poked around a bit, but there's not much free room, especially with fully-loaded expansion slots.

The I/O bus, which rises vertically from the left edge of the motherboard, provides five horizontal slots—three 16-bit slots on its left side and two 8-bit slots on its right. However, if you get the machine with its standard configuration of two serial ports and one parallel port, you'll find that one of the 8-bit slots is unusable: though the port controller is integrated into the motherboard, the rear panel has room for only one port, forcing two of the ports to occupy one of the 8-bit-slot openings.

An Adaptec controller capable of supporting two hard disks occupied one of the three 16-bit slots in our evaluation unit, and an 8-bit VGA card—stamped MIR-AVGA and offering both analog and TTL connectors—occupied another.

Arche can brag about a bit of clever design work when it comes to squeezing the three half-height drives into this machine. An optional 3½-inch drive (hard or floppy disk) mounts in a removable saddle that bolts to the top of the drive-bay housing on the right and the I/O bus support brace on the left. It may not sound like ingenious design, but to remove the drive you simply unscrew four easy-to-reach screws.

The disk drives in our evaluation unit were a 28-millisecond 44MB Micro-series hard disk, a TEAC 3½-inch and a NEC 5¼-inch floppy disk drive. The system's 150-watt power supply provides four leads.

Other equipment included an Arche 14-inch VGA monitor and a 101-key Enhanced keyboard. The VGA adapter/monitor combination performed well during testing, maintaining a consistent screen size when jumping to new graphics modes. If you want 16-bit speed, however, you should opt for another adapter. And the keyboard was solidly built but may not be clicky enough for hard-core IBM keyboard fans.

Arche provides DOS 3.3, Ontrack



FACT FILE

Arche Triumph 286

Arche Technologies Inc., 48881 Kato Rd., Fremont, CA 94539; (800) 422-4674, (415) 623-8100.

List Price: With 512K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, monochrome monitor, DOS 3.3, \$1,495; with 1MB RAM, 40MB hard disk, VGA monitor, \$3,359; with 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drives, \$3,525.

In Short: A solidly built, zero-wait-state machine that boasts a 2-year parts-and-labor warranty. Its small number of expansion slots and 1MB maximum motherboard memory limit its applications.

CIRCLE 386 ON READER SERVICE CARD

Computer Systems' *Disk Manager*, Version 4.0, and *Arche Fastlane*, a relabeled version of *PC-Kwik*, with every machine. The Arche documentation is not terribly generous with technical information, but it is well written and illustrated and does a nice job with the basics.

On the one hand, the Arche Triumph 286 is a wonderful little PC. The chassis feels solid, the system as a whole looks good and fits nicely on a desktop, and the system's performance is good, if not breathtaking. The unusually confident 2-year warranty (18 months on the monitor) doesn't hurt, either.

On the other hand, this machine leaves you very little room for growth. The motherboard accommodates a maximum of only 1MB of RAM, and the I/O bus gives you only two slots to play with once the hard disk controller, video adapter, and standard ports are installed. These limitations make it difficult to recommend this machine for use as anything but a limited network workstation.

COMMODORE BUSINESS MACHINES INC.

Commodore PC40-III

by Bruce Brown

Commodore Business Machines has been in the PC business since the late 1970s. While most people in the United States associate Commodore with home computers, the company's business-oriented division sold powerful computers through the early eighties. In Europe, Commodore has continued to sell in the business world, but only recently has this company made a sig-

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EDITOR'S CHOICE

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June 13, 1989

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Commodore PC40-III

The 19-ms. 40MB Quantum hard disk and controller combination used in the \$2,595 monochrome VGA Commodore PC40-III was co-designed with Commodore for high performance.



nificant return to the domestic market. The Commodore PC40-III, Commodore's 12-MHz AT-class machine, has a small case and comes with lots of fine, standard equipment at a reasonable price.

The basic PC40-III includes 1MB RAM, a 40MB 19-millisecond hard disk with special high-transfer-rate controller circuitry, a 1.2MB 5¼-inch floppy disk drive, one serial port, one parallel port, a mouse port, an RGB port, and an RCA jack for an external speaker. VGA circuitry controlled by Paradise chip technology is built into the motherboard. All of this, plus DOS 3.2 and GW-BASIC, costs \$2,395. Commodore doesn't yet sell a color VGA monitor; the black-and-white-screen monochrome monitor that was supplied with the system that we tested raises

the price of the package by \$200.

The PC40-III's case measures 6 by 14 by 15 inches (HWD). There is room for three drives, two of which have exposed fronts. There are four full-length expansion slots—three 16-bit and one 8-bit—all of which were vacant in the test machine. The power supply is rated at 112 watts, which is adequate for what it could potentially have to run.

The system can be set to run at 6, 8, or 12 MHz, all with one memory wait state. Early units coupled expansion bus speed to the system speed, which made it tricky to buy add-on boards if you were going to use the system at 12 MHz since some cards won't run that fast. The current version limits bus speed to 6 or 8 MHz.

Commodore makes its own motherboard and uses its own ROM BIOS with setup in ROM, which includes an Auto-config function to recognize major additions. The 286 chip set is by Faraday. The standard 1MB of RAM is the maximum that will fit on the motherboard; if you want more, you must purchase a memory expansion card. Commodore does not use memory interleaving or RAM shadowing on this machine.

The hard disk and circuitry on the PC40-III merit special mention. The 19-ms. 40MB unit is manufactured by Quantum and has integrated controller circuitry. Rather than using the standard ST-506, ESDI, or SCSI interface, this drive has what's called an AT-Interface. The drive is optimized for a higher-than-standard data transfer rate, but its controller circuitry makes it look like an ST-506 drive with MFM (Modified Frequency Modulation) coding to all software that calls for it. The aim of this special drive/circuitry combination is improved performance, but it doesn't always show.

The PC40-III's video, processor, and memory benchmark test scores are no better than average, while the hard disk scores are unusual. The small-record DOS File Access test score is the slowest in this roundup, but the BIOS Disk Seek test score is the third-fastest. Smaller records are accessed much slower than large records, reflecting the advantage of the 32K hard disk cache.

In practice, if you use this machine in a small-record situation, such as transaction processing, it may not be too fast compared with others. But in large-record applications such as document-oriented word

FACT FILE

Commodore PC40-III
Commodore Business Machines Inc., 1200 Wilson Dr., West Chester, PA 19380; (800) 627-9995, ext. 600; (215) 431-9100.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5¼-inch floppy disk drive, VGA circuitry on the motherboard, DOS 3.2, and GW-BASIC, \$2,395; with monochrome VGA monitor, \$2,595.
In Short: Commodore's standard PC40-III comes fully equipped except for a monitor. This computer's performance is enhanced by a fast hard disk, and its price compares well with all but the most aggressive mail-order houses. Skip its monochrome VGA monitor and buy color elsewhere.

CIRCLE 387 ON READER SERVICE CARD

processing or manipulating huge spreadsheets (both more appropriate for this computer than transaction processing), the PC40-III's performance should make you smile.

Commodore makes its own keyboard, a typically arranged 101-key design with a noticeably dead feel.

The Commodore PC40-III is sold through dealers, not by mail, and it is serviced at any of over 700 authorized dealers or service centers. A 1-year parts-and-labor warranty comes standard.

Although Commodore may have an uphill fight for recognition as a business PC vendor in this country, the PC40-III, widely available and heavily discounted, is a good performer and a good deal.

COMPAQ COMPUTER CORP.

Compaq Deskpro 286e

by Bruce Brown

Compaq Computer Corp. was the first to market an 80386-based computer and currently is a market leader in that realm of higher-end computers. Compaq hasn't grown by being stupid, however, and its newest 80286-based computer, the Compaq Deskpro 286e, is its bid to stay active in the profitable 80286 market. The small-footprint Deskpro 286e takes its place beside the full-sized Deskpro 286, which Compaq continues to sell for those who want a full-sized box.

The Deskpro 286e looks like Compaq's Deskpro 386/20e because many of the parts are the same. The 286 machines are a relative bargain, however, with a floppy-

disk-drive-only Model 1 priced at \$2,699, a 20MB-hard-disk Model 20 at \$3,199, and the 40MB Model 40 costing \$3,599 (\$4,448 with VGA monitor and DOS 4.01). The floppy-only version costs \$2,500 less than the corresponding 386/20e, which lists at \$5,199. You save even more with the 40MB version of the Deskpro 286e, which is a full \$3,000 less than the \$6,599 386/20e with 40MB hard disk. If you can live with 286 power, you'll save lots of money.

The Deskpro 286e is nominally a 12-MHz machine. The CPU is rated at 12 MHz, but it actually runs a bit slower, at 11.8 MHz. Compaq added an extra memory refresh cycle in the interest of compati-

**While the Compaq's
processor, memory, and
hard disk speeds are only
passable, the video
is exceptional, thanks
to built-in 16-bit
VGA circuitry.**

bility, exacting a minor toll on overall system performance. Memory runs with one wait state.

The Deskpro 286e measures 6 by 15.75 by 15 inches (HWD). Many standard features are built-in on the motherboard, allowing reasonable expansion within a small-cased machine. Standard components include 1MB of RAM, one parallel and one serial port, a mouse port, drive controllers, and a 16-bit VGA controller. None of these accoutrements use any of the four 16-bit AT-style expansion slots. The expansion bus runs at a normal 8 MHz for compatibility.

One extra 16-bit slot is reserved for a proprietary memory expansion card, which if fully loaded can bring the Deskpro 286e up to 13MB of 16-bit memory without using a standard slot. The memory slot trucks along at the full 11.8-MHz system speed.

You can add a variety of storage devices to the Deskpro 286e. The test machine came packed with the standard quar-



12-MHZ 286 PCS: SUMMARY OF FEATURES

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

Basic configuration This price represents the most stripped-down machine the vendor will sell, typically including 1MB RAM, one floppy disk drive, and serial and parallel ports.

Hard disk options The available hard disks are identified in terms of their storage capacity. Each disk uses an ST-506 interface except as otherwise indicated (see **disk controller interface/encoding**, below). The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available.

Standard configuration For the sake of price comparisons, our "standard" configuration normally includes 1MB RAM, a 40MB hard disk, at least one floppy disk drive, a VGA monitor, at least one parallel and one serial port, DOS, and a keyboard. Because the closest approximation of our standard package may differ from this configuration, the price of each system is followed by the total RAM (if other than 1MB), the size of the hard disk (if other than 40MB), and any other departures from our specification.

Tested configuration The specifications of the evaluation units depend on what configuration each manufacturer has sent us (based on our guidelines).

Bus clock speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 or 10 MHz. Time-out periods, sometimes called **wait states**, are often used to slow down the bus.

Disk controller interface/encoding Several interfaces are used to control the way data is transferred from the hard disk to the computer. The most common disk interface standard is ST-506/E12, used in the IBM PC-XT and PC AT. Two other common data transfer interfaces are SCSI (Small Computer System Interface) and ESDI (Enhanced Small Device Interface). Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers.

Disk encoding techniques currently include RLL (Run Length Limited) and the older MFM (Modified Frequency Modulation) scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. Nine such bits would be needed to store 12

bits of data in MFM format, and only six polarity changes are required with RLL format; thus, MFM takes more space than RLL but provides a more stable environment and is more commonly used. ST-506 technology, for instance, uses the MFM encoding scheme.

BIOS version and date The BIOS date is important to those planning to use 3½-inch disk drives. Early BIOS versions cannot handle this format.

Memory chip type Kb and Mb refer to kilobits and megabits, respectively.

Chip packaging Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs. The Dual in-line Package (DIP) is the traditional buglike computer chip sprouting 8, 14, 24, or even 40 or more metal legs (evenly divided between right and left sides). Single in-line Packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb.

Single in-line Memory Modules (SIMMs), on the other hand, are individual logic devices that are installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement duplicates the integrated structure of a SIP but allows for the possibility of replacing an individual memory component if necessary.

All of the computers in this features table use dynamic RAM chips (DRAMs). These cost less and are more common than static RAM chips (SRAMs), but they also yield slower performance.

Interleaved memory CPU speed is usually faster than memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer. The BIOS then operates much faster.

FCC certification class Two classes of FCC (Federal Communications Commission) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

CONTINUES

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CIRCLE 321 ON READER SERVICE CARD



12-MHz 286 PCS: SUMMARY OF FEATURES

(Products listed in ascending price order)

	Finch 286-12 National MicroSystems Inc.	Destiny 286 Destiny Computers	CPU 286-12 Computer Products United	MIT Systems 286-12 Teleport	CompuAdd 286-12 CompuAdd Corp.
BASIC CONFIGURATION					
List price	\$699	\$875	\$895	\$929	\$945
RAM	512K	512K	512K	512K	512K
Floppy disk drives	1.2MB	1.2MB or 1.44MB	1.2MB or 1.44MB	1.2MB	1.2MB or 1.44MB
Hard disk options (MB)	20, 40, 80, 100	20, 40, 60, 80, 120; ESDi 90, 160, 325	20, 40, 66, 72, 107, 150, 330	20, 40, 80, 200, 300	20, 40, 60, 71, 80, 90, 117, 150, 320, 630
Number of drive bays	5	5	5	3	5
Software included	None	LIM 4.0	None	EMS drivers	Setup, utilities
Slots	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	5	5	5	5	5
Monitor	None	None	None	None	None
Power supply (watts)	200	200	200	200	200
Keyboard cable length (inches)	90	72	84	72	60
STANDARD CONFIGURATION					
List price	\$1,949	\$2,610	\$2,272	\$1,974	\$2,402
TESTED CONFIGURATION					
List price	\$1,749	\$3,533	\$2,359	\$1,974	\$2,537
Tested configuration includes	1MB RAM, 1.2MB floppy disk drive, 20MB hard disk, VGA monitor, DOS 3.31	2MB RAM, 1.2MB floppy disk drive, 90MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 4.01	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.31	1MB RAM, 1.2MB and 1.44MB floppy disk drives, 40MB hard disk, VGA monitor, DOS 3.3
Microprocessor clock speeds (MHz)	8, 12	6, 12	6, 12	6, 12	6, 12
Bus clock speeds (MHz)	8	6, 8	6, 8	6, 8	6
Wait states	0, 1	0, 1	0, 1	0, 1	0, 1
Disk controller manufacturer	Western Digital	Adaptec	NDC	Western Digital	Western Digital
Interface/encoding	ST-506 (MFM)	ESDI	ST-506 (MFM)	ST-506 (MFM)	ST-506 (MFM)
Drives handled by controller	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives
BIOS version and date	AMI 286 BIOS, Version 1.02 (November 1987)	Award BIOS, Version 3.03 GS (Fall 1988)	Phoenix 80286 ROM BIOS Plus, Version 3.10 00 (January 1988)	AMI 286 BIOS, Version 2.01 (September 1988)	Award BIOS, Version 3.03 (November 1988)
System board manufacturer	ATronics International	Sigma Designs	Computer Products United	MIT Systems	CompuAdd
286 chip set manufacturer	G2	Suntac	VLSI Technologies	Suntac	None (uses discrete logic)
MEMORY SPECIFICATIONS					
Memory chip type	256Kb	256Kb, 1Mb	256Kb	256Kb	256Kb
Chip packaging	DIP	DIP	DIP	DIP	DIP
RAM chips	DRAM	DRAM	DRAM	DRAM	DRAM
Interleaved memory	○	○	○	●	○
Shadow RAM	○	○	○	●	○
Maximum RAM on motherboard	4MB	4MB	4MB	4MB	1MB
Maximum total system RAM	16MB	16MB	16MB	16MB	16MB
OTHER					
Warranty	1 year; 30-day money-back guarantee	1 year	1 year (18 months on motherboard)	1 year on-site service; 30-day money-back guarantee	1 year
FCC certification class	B	B	A	B	B
Password security	○	○	○	○	○

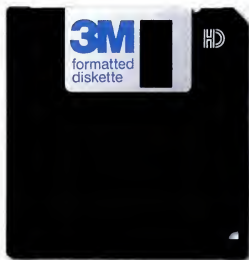
● — Yes ○ — No * This hard disk is included in the basic configuration.

COMPUTERS
12-MHz 286 PCs

Swan 286/12 Tussey Computer Products	ESD Series 2000 ESD Computers Inc.	MultiMicro 286/12 MultiMicro Inc.	Arche Triumph 286 Arche Technologies Inc.	Hyundai Super-286N Hyundai Electronics America	Maxar 286L Maxar PCs
\$999	\$1,460	\$1,480	\$1,495	\$1,595	\$1,768
512K	512K	1MB	512K	1MB	1MB
1.2MB	1.2MB	1.2MB	1.2MB	1.2MB	1.2MB
40, 80	20, 40, 80, 150	20, 30*, 45, 63, 100; ESDI: 150, 330, 650; SCSI: 40, 80	20, 40, 62, 80, 95, 120; ESDI: 122	40	20, 40
5	4	4	3	4	2
Setup, utilities, DOS 3.31	None	DOS 3.3, EMS drivers, GW-BASIC	Disk cache, DOS 3.3, GW-BASIC	Diagnostics, DOS 3.3, GW-BASIC	DOS 4.0, GW-BASIC
Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, six 16-bit	Two 8-bit, three 16-bit	Two 8-bit, four 16-bit	Six 16-bit
5	5	6	2	4	4
None	None	14-inch monochrome	14-inch monochrome	None	None
200	200	200	150	200	150
100	108	72	72	80	72
\$2,367	\$3,268	\$2,394	\$3,359	\$3,439	\$2,295
\$2,367	\$3,268	\$3,450	\$3,528	\$3,569	\$2,295
1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.31	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3	4MB RAM, 1.2MB and 1.44MB floppy disk drives, 40MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 1.2MB and 1.44MB floppy disk drives, 40MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 360K and 1.2MB floppy disk drives, 40MB hard disk, VGA adapter, EGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 4.0
6.25, 12.5	11.9	6, 12	6, 12	6, 12	8, 12
6.25	8	6, 12	6, 8	6	8, 11, 727
0, 1	0, 1	0, 1	0	0, 5	1
Adaptec ST-506 (MFM)	NDC ST-506 (MFM)	Western Digital ST-506 (MFM)	Adaptec ST-506 (MFM)	Hyundai ST-506 (MFM)	Western Digital ST-506 (MFM)
Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and one hard disk	Two floppy or one floppy and one hard disk drive
Phoenix ROM BIOS Plus, Version 3.10 11 (April 1989)	Phoenix ROM BIOS Plus, Version 3.10 00 (November 1988)	Phoenix ROM BIOS Plus, Version 3.10 10 (January 1988)	Phoenix ROM BIOS Plus, Version 3.10 10 (January 1988)	Award BIOS, Version N4.13a (March 1989)	Award BIOS, Version 3.03 HY 0 (1988)
Twinhead International Chips and Technologies	ESD Computers	VIP	Arche	Hyundai	Maxar PCs
	VLSI Technologies	Suntac	VLSI Technologies	Chips and Technologies	Intel
256Kb DIP	256Kb DIP	256Kb, 1Mb DIP	256Kb DIP	256Kb SIMM	256Kb DIP
DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
●	○	○	○	●	○
●	○	○	○	●	○
1MB	1MB	4MB	1MB	4MB	1MB
16MB	16MB	16MB	16MB	16MB	16MB
1 year; 30-day money-back guarantee	1 year	1 year; 30-day money-back guarantee	2 years (18 months on monitor)	18 months	1 year
A ○	A ○	A (pending) ○	B ○	B ○	B ○

CONTINUES

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3M

CIRCLE 521 ON READER SERVICE CARD



12-MHz 286 PCs: SUMMARY OF FEATURES

(Products listed in ascending price order)

	Sunrise 286-12 Sunrise Technology Inc.	Mitsubishi MP286 Mitsubishi Electronics America Inc.	Tandon PCA-12 Tandon Corp.	Premier 1000 Plus Premier Computer Innovations
BASIC CONFIGURATION				
List price	\$1,799	\$1,895	\$2,025	\$2,295
RAM	1MB	640K	1MB	1MB
Floppy disk drives	1.44MB	1.2MB or 1.44MB	1.2MB	1.2MB
Hard disk options (MB)	30, 49	20, 40	40, 110	20, 30, 40, 80
Number of drive bays	3	None	5	5
Software included	Utilities, LIM 4.0 4.0	DOS 4.0, GW-BASIC	DOS 3.3, GW-BASIC, Microsoft Windows 2.1, memory management	Video driver, LIM 4.0
Slots	One 8-bit, two 16-bit	Two 8-bit, four 16-bit	Two 8-bit, three 16-bit	One 8-bit, three 16-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	3	3	5	3
Monitor	None	None	None	None
Power supply (watts)	116	154	190	200
Keyboard cable length (inches)	72	72	60	81
STANDARD CONFIGURATION				
List price	\$2,639 (30MB hard disk, no monitor)	\$4,195 (640K RAM)	\$3,997	\$3,942
TESTED CONFIGURATION				
List price	\$4,439	\$4,493	\$5,245	\$3,942
Tested configuration includes	3MB RAM, 1.44MB floppy disk drive, 30MB hard disk, EGA adapter, 80287 coprocessor, DOS 3.3	1.64MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, 30MB Data Pac, VGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3
Microprocessor clock speeds (MHz)	6, 8, 12	6, 8, 12	8, 12	6.26, 12.5
Bus clock speeds (MHz)	6, 8, 12	6, 8	8	6.25, 8
Wait states	0, 1	1	0, 5, 1	1
Disk controller manufacturer	Wastem Digital	Wastem Digital	Connor	Western Digital
Interface encoding	ST-506 (MFM or RLL)	ST-506 (MFM)	ST-506 (MFM)	ST-506 (MFM)
Drives handled by controller	Two floppy and one hard disk drive	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives
BIOS version and date	Award BIOS, Version 3.03 (June 1988)	Phoenix ROM BIOS Plus, Version 3.10 (January 1988)	Tandon BIOS, Version 3.13 (May 1989)	Phoenix ROM BIOS Plus, Version 3.10 00 (April 1989)
System board manufacturer	Sunrise	Mitsubishi	Tandon	Western Digital
286 chip set manufacturer	VLSI Technologies	Mitsubishi	Tandon	Faraday
MEMORY SPECIFICATIONS				
Memory chip type	256Kb (DIP), 1Mb (SIMM)	256Kb	256Kb	256Kb
Chip packaging	DIP, SIMM	DIP	SIMM	SIMM
RAM chips	DRAM	DRAM	DRAM	DRAM
Interleaved memory	○	○	●	○
Shadow RAM	●	○	○	●
Maximum RAM on motherboard	3MB	4MB	5MB	4MB
Maximum total system RAM	16MB	16MB	16MB	16MB
OTHER				
Warranty	1 year	1 year (carry-in service)	1 year	1 year on-site service
FCC certification class	B	B	B	B
Password security	○	○	○	○

● — Yes ○ — No * This hard disk is included in the basic configuration.

COMPUTERS
12-MHz 286 PCs

Everex Step 286-12 Everex Systems Inc.	WYSEpc 286 Model 2112 Wyse Technology	Commodore PC40-III Commodore Business Machines Inc.	HP Vectra ES-12 Hewlett-Packard Co.	Compaq Deskpro 286e Compaq Computer Corp.	HeadStart III HeadStart Technologies Co.
\$2,299	\$2,299	\$2,395	\$2,495	\$2,899	\$2,995
1MB	1MB	1MB	640K	1MB	1MB
1.2MB or 1.44MB	1.2MB	1.2MB	1.2MB or 1.44MB	1.2MB	1.2MB and 1.44MB
40, 80; ESD: 160, 330	40	40*	20, 40	20, 40, 110	32*
3	3	3	3	4	3
Disk cache, DOS 3.3, GW-BASIC	DOS 3.3, GW-BASIC	DOS 3.3, GW-BASIC	Setup, DOS 3.31, terminal emulation	EMS drivers	DOS 3.3, GW-BASIC, Framework II and other bundled software
Two 8-bit, six 16-bit	Two 8-bit, five 16-bit	One 8-bit, three 16-bit	Two 8-bit, five 16-bit one proprietary 16-bit	Four 16-bit, one proprietary 16-bit	Six 18-bit
5	4	4	5	4	3
None	None	None	None	None	None
200	200	112	176	140	145
72	108	84	108	90	84
\$3,499	\$4,067	\$2,595 (monochrome VGA monitor)	\$4,410 (640K RAM)	\$4,448	\$3,790 (32MB disk)
\$3,499	\$4,067	\$2,595	\$6,105	\$7,120	\$3,790
1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3	1MB RAM, 1.2MB floppy disk drive, 40MB hard disk, monochrome VGA monitor, DOS 3.3	2.6MB RAM, 1.2MB floppy disk drive, 40MB hard disk, VGA monitor, DOS 3.3	2MB RAM, 1.2MB and 1.44MB floppy disk drives, 40MB hard disk, 40MB tape backup, VGA monitor, 80287 chip, DOS 4.01	1MB RAM, 1.2MB floppy disk drive, 32MB hard disk, VGA monitor, DOS 3.3
4, 6, 12	8, 12.5	6, 8, 12	12	8, 11.8	8, 12
4, 6	8	6, 8, 12	8	8 (12 for memory slot)	11.7 (8 for I/O access)
0, 1	1	0, 1	1	1	1
Omit	Western Digital	Quantum	Western Digital	Compaq	Western Digital
ST-506 (MFM)	ST-506 (MFM)	Proprietary	ST-506 (MFM)	ST-506 (MFM)	ST-506 (MFM)
Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and two hard disk drives	Two floppy and one hard disk drive
AMI Everex BIOS, Version F4S-23 (February 1989)	Phoenix ROM BIOS Plus, Version 2.75 (August 1988)	Commodore 286 BIOS, Version 2.0 (January 1989)	HP BIOS, Version B.02.01 ES-12 (Fall 1988)	Compaq BIOS, Version A (April 1989)	HS-III, Version 1.3 (March 1989)
Everex	Wyse	Commodore	Hewlett-Packard	Compaq	HeadStart Technologies
Everex	VLSI Technologies	Faraday	Chips and Technologies	Compaq	Intel
256Kb, 1Mb	256Kb	1Mb	256Kb	256Kb	256Kb
DIP	DIP	DIP	DIP	DIP	DIP
DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
○	○	○	●	○	○
○	○	○	○	○	○
4MB	1MB	1MB	640K	1MB	1MB
16MB	16MB	16MB	8MB	13MB	16MB
1 year on-site service	1 year	1 year	1 year; 90 days on-site service	1 year	18 months on-site service
B	B	B	B	B	A
○	●	○	○	●	○

ENDS

COMPUTERS

12-MHz 286 PCs

ter-height 1.2MB 5¼-inch floppy disk drive as well as a quarter-height 1.44MB 3½-inch floppy disk drive (a \$275 option) and a half-height 40MB tape drive (\$799). In addition, a 40MB hard disk was transverse-mounted inside the machine. If you don't want a tape drive, you could opt for a second 40MB (\$1,399) or even a wall-kop- ing 110MB hard disk (\$2,799) for the front half-height slot.

The test unit also came with one extra megabyte of memory (mounted on the memory expansion card), priced at \$799, and a 12-MHz 80287 math coprocessor chip, which also costs \$799. Compaq's fine Video Graphics Monitor filled out the package—for an additional \$699—making the grand total, with DOS 4.01, an unbelievable \$7,120.

Compaq Deskpro 286e

The 40MB hard disk is mounted transversely in the back of the \$4,448 Compaq Deskpro 286e, leaving the three front drive bays open for removable media.



While the Deskpro 286e's processor, memory, and hard disk benchmark-test speeds are only passable, the video display speeds are exceptional, thanks to built-in 16-bit VGA circuitry. Graphics screen rewriting is fast and crisp.

Compaq will sell you its version of DOS 3.31 for \$120, DOS 4.01 for \$150, or MS-DOS/2.1.1 for \$340. Standard software for the 286e includes Compaq's CEMM (extended memory manager) and Disk Cache program.

The Deskpro 286e's 140-watt power supply is ample for the number and size of storage, memory, and processing components you can add to this computer. There is no reset switch, so you have to turn the power completely off if you get hung, using the front-mounted power switch.

The keyboard, a typical 101-key Enhanced-style unit, has a better feel than earlier Compaq models; now we can call it soft rather than mushy. The keyboard cable is a generous 100 inches long.

Compaq has never sold bargain-basement computers. The list price of the options-loaded evaluation unit is a whopping \$7,120, so if you're looking for price only, look elsewhere. Luckily, Compaqs are often heavily discounted by dealers. People usually buy Compaq machines for the reassurance of the brand name and for the engineering quality.

With the Deskpro 286e, the engineering shows in blazing video display speeds and in how well the number of components fit in a small box. If you are satisfied with adequate expansion capacity and 286 power but demand top video performance, the Deskpro 286e was built for you.



FACT FILE

Compaq Deskpro 286e

Compaq Computer Corp., 20555 SH 249, Houston, TX 77269-2000; (713) 370-0570. List Price: With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, \$2,899; with 40MB hard disk, VGA monitor, DOS 4.01, \$4,448; with 2MB RAM, 40MB tape backup, 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drives, VGA monitor, 80287 coprocessor, \$7,120.

In Short: Compaq's small-footprint 12-MHz Deskpro 286e is a fine late entry in the 286 race. Parallel, serial, and mouse ports, drive controllers, and a VGA controller are all standard. The product has limited expansion possibilities and is expensive, but you can expect good discounts from dealers.

CIRCLE 388 ON READER SERVICE CARD

COMPUADD CORP.

CompuAdd 286/12

by Bruce Brown

Components 'R Us. CompuAdd Corp. is one of the largest mail-order hardware and software companies in the country. CompuAdd has also recently started opening retail stores, most of them in its home state of Texas. CompuAdd continues to expand its product line, allowing you to configure a system with just about everything you might want to put into a computer.

CompuAdd's entry in the workhorse AT class is the CompuAdd 286/12. The base model, listing at \$945, starts with 512K RAM and a 1.2MB 5¼-inch floppy

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CIRCLE 732 ON READER SERVICE CARD

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COMPUTERS
12-MHz 286 PCs

disk drive. Everything else is extra. The test configuration, with 1MB RAM, a 40MB Seagate hard disk, an additional 1.44MB 3½-inch floppy disk drive, a VGA adapter and monitor, one parallel and one serial port, and DOS 3.3, costs \$2,491. The same system with two serial ports but without the second floppy disk drive costs \$2,402.

The CompuAdd 286/12 comes in a big box, 6.5 by 21 by 16.75 inches (HWD). There's plenty of room inside the case, and the various supports and covers are reassuringly thick and sturdy. This case is about as big as they get, so it takes up lots

of space, but the components and cables all have plenty of room.

The 286/12 CPU runs at 6 or 12 MHz, with a switch mounted on the back for instant and convenient changes. You can select zero or one wait states via a motherboard jumper switch. The bus speed is a steady 6 MHz, a relatively conservative rate that reflects the age of this machine's design but also ensures that your cards won't be outstripped by too speedy a bus. CompuAdd's large box has a full complement of six 16-bit slots and two 8-bit expansion slots.

Standard memory is 512K, with no page interleaving or other memory-enhancement tricks. The motherboard holds 1MB of RAM, but with optional memory expansion cards you can build the unit up to 16MB. CompuAdd makes its own motherboard and uses Award Software's BIOS and discrete 286 logic chips.

Even though CompuAdd doesn't push the limits of technology with this machine, it is one of the most respectable performers on PC Labs' benchmark tests for processor speed and conventional memory. Com-

puAdd's scores demonstrate that good design does pay off.

The standard Western Digital floppy/hard disk controller is an ST-506 interface unit with MFM coding. There is ample room for five half-height storage devices in the system box, with three showing for removable media. The 200-watt power supply has the five power leads necessary for a full house of storage devices. A system reset switch is located on the front of the unit; the power switch is on the back.

No parallel or serial ports are standard on this computer. CompuAdd's normal AT-class I/O card (\$59) has one serial and one parallel port. A second serial port costs just \$15. The 101-key Enhanced keyboard, manufactured by Hi-Tek, has a 60-inch cable and a slightly mushy feel. The keyboard has an electronic click that you can turn on or off.

Standard software includes setup software and CompuAdd's *Integrator* program, a productivity package with several helpful utilities and desktop accessories like a calculator and calendar.

The CompuAdd 286/12's price is midrange for mail-order dealers. CompuAdd offers a standard 1-year parts-and-labor warranty and a 30-day money-back guarantee, plus a wide hardware and software product line for one-call shopping.

The extra touches, such as easily replaceable AA batteries, a back-of-the-box speed switch, and sturdy case construction, simply enhance CompuAdd's reputation as a solid company that continues to improve its products. The assurance of dealing with a major mail-order vendor with good if not headline-worthy prices makes this unit a good choice.

COMPUTER PRODUCTS UNITED

CPU 286/12

by Bruce Brown

It's easy to dismiss Computer Products United's CPU 286/12 as just another clone, but that wouldn't be fair. Sure, the usual components are in the normal arrangement, the price is average for a mail-order machine, and performance is also as expected from a 12-MHz system. What differentiates this box from hundreds of others on the market is a few minor touch-

CPU 286/12

The CPU 286/12 has a reset switch that won't reboot unless you hold it for 1½ seconds. This smart machine lists for \$2,272 with 1MB of RAM, a 40MB hard disk, and a VGA monitor.



es that show thought and consideration for the user.

The basic 80286 unit costs only \$895 for a 512K RAM model with one floppy disk drive and a keyboard but no hard disk, video adapter, or monitor. This system also includes two serial ports, one parallel port, and a game port. A system with 1MB RAM, a 40MB hard disk, a top-rated Video Seven 8-bit VGA card, a Mitsubishi VGA monitor, and DOS 4.01 costs just \$2,272. Nothing to shout about, but this certainly is a good deal.

The CPU 286/12 is a dual-speed 6- or 12-MHz machine, set for either zero- or one-wait-state memory performance. The expansion bus runs at 6 MHz at the slower processor speed and at 8 MHz when in turbo (12-MHz) mode. The memory chips on

PC FACT FILE

CompuAdd 286/12
CompuAdd Corp., 12303-G Technology Blvd., Austin, TX 78727; (800) 627-1967, (512) 250-1489.
List Price: With 512K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, \$945; with 1MB RAM, 40MB hard disk, VGA monitor, DOS 3.3, \$2,402; with 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drives, \$2,491.
In Short: CompuAdd's workhorse 12-MHz AT-class machine has the right stuff in the right packaging, including an exceptionally sturdy case. CompuAdd offers many options; the test configuration is a good combination of features, performance, and value.

CIRCLE 399 ON READER SERVICE CARD

Personal computers are surprisingly reliable, and it's tempting to make purchase decisions based just on hardware features, performance, and price. But what do you do if something goes wrong? Your choices include fixing it yourself, carrying or shipping the computer to a dealer or vendor, or buying an on-site service contract. You can take your chances, hoping that everything will be OK, and face the question only if a component fails—but if your business computer needs demand that service interruptions be minimal, it makes sense to plan ahead. Many businesses today demand on-site service contracts as the least disruptive way to handle service problems.

Of course, computer systems come with parts-and-labor warranties, usually in effect for 1 year. Pleasant exceptions include Arche Technologies' machines with 2-year coverage, as well as Hyundai Electronics America and HeadStart Technologies Co., both of which give 18-month warranties. Warranties don't usually cover shipping costs, however. Unless you have an on-site service contract, you are responsible for delivering or shipping a failed component to a dealer, vendor, or service center. If the service site is local, time must be spent carrying the machine to and from the location; the service you get is called *carry-in* or *depot* service.

Shipping a machine to a remote vendor is costly. For example, sending a 45-pound, AT-class computer insured at \$2,000 from Connecticut to San Diego for second-day delivery costs \$50.25 via UPS or \$63.60 with Federal Express (including pickup at your office). Next-day service costs even more: \$66.50 for

THE SERVICE QUESTION

by Bruce Brown

delivery by noon via UPS, or \$96.35 for delivery by 10:30 A.M. via Federal Express.

Most people don't ship computers for service unless they buy them from mail-order dealers that don't use local service firms. Standard practice with most mail-order companies is what's called "mirror" shipping, in which the vendor pays to ship the computer back to you and uses the same shipping method you selected. The only exception to this practice among major mail-order vendors is HiTech International in Milpitas, California; this company insists on having customers pay shipping both ways, even for warranty service. HiTech maintains that part of the secret of offering low system prices lies in not making people whose machines never fail subsidize the shipping costs for the few machines that do.

After you've carried in or shipped your computer, turnaround time—the

time it takes to diagnose and repair your machine—varies so widely that we can only generalize. In most cases, figure 2 to 5 business days, with better response from larger dealers or vendors with adequate staffing.

For fastest response and repair turnaround, get yourself an on-site service contract. Depending on the contract's specifics, you'll be up and running in anywhere from 4 hours to 2 business days. Some on-site contracts even include a provision for equipment loaners if the repair can't be made on the spot. Large corporations increasingly specify on-site service contracts in their orders.

Mail-order companies, in their never-ending fight for credibility, rely more and more on on-site service contracts, often including them free with system purchases. Some machines sold only through dealers include standard on-site service contracts as well. Austin Computer Systems, Dell Computer Corp., FiveStar Computers, Fortron Corp., HeadStart Technologies Co., Hertz Computer Corp., Northgate Computer Systems, Premier Computer Innovations, Telemart, and Televideo Systems all give free on-site service through the duration of the warranty.

Two companies, recognizing that most part failures occur early in a computer's life, offer full-year warranties but include on-site service for just part of the time: Hewlett-Packard Co. for the first 90 days and Acer Technologies Corp. for the first 4 months of the warranty period.

If your computer doesn't come with an on-site contract as standard, you can usually buy one from the dealer, whether local or mail-order, or from a national service center such as



the motherboard are a speedy 80-nanosecond type, faster than necessary but great to have with a 12-MHz processor. The CPU 286/12 neither uses memory interleaving nor shadows the video or ROM BIOS, but its performance on our benchmark tests is still respectable. While the stock machine uses 256-kilobit memory chips, you can also use 1-megabit chips for a motherboard maximum of 4MB RAM.

The standard desktop-size case measures 6.5 by 19.5 by 16.75 inches (HWD). Computer Products United makes its own motherboard using VLSI Technologies 286 chips and Phoenix ROM BIOS chips. The board has the usual six 16-bit and two 8-bit expansion slots. There's room for five half-height drives, three of which can use removable media. One minor drawback is the CPU 286/12's power supply.

The 200-watt supply has four leads for storage devices, so if you actually use all five drives you'll need to split the last power lead. (You should use a power lead splitter only for two floppy disk drives since they can't run at the same time anyway, while hard disks need constant power.)

The standard floppy/hard disk controller can run two hard and two floppy disk drives. It's a 1:1 interleave ST-506 con-

TRW, Sorbus, or GE-OnSite, all of which have sites in major metropolitan areas in the U.S. These, incidentally, are the companies that most mail-order dealers use for their on-site contracts.

ComputerLand franchise stores in the New England area sell on-site contracts at yearly rates ranging from 8 to 12 percent of the original system list price. For the \$4,448 Compaq Deskpro 286e reviewed in this issue, a 1-year contract would cost between \$355 and \$533, the difference determined by the length of the response time. A 1-year contract for the \$2,367 Tussey Computer Products Swan 286/12, including the VGA monitor, costs \$270 (Tussey sells the contract but Sorbus provides the service).

Carry-in, mail-in, and on-site service aren't the only ways to get help. Some of the better-known mail-order vendors offer special ways to help with system problems: quick, cheap, and effective if you can do some of your own work. Many vendors, including CompuAdd Corp., Tussey Computer Products, and Zeos International offer toll-free technical support. DataWorld uses another technique: since all of its systems include the "host" half of the remote-operation software *pcAnywhere III*, DataWorld's technicians can diagnose your system via telephone (you must provide a modem and phone line for them to get into your system).

If you're hardware savvy and have the time, you can often perform computer service yourself, which in most cases consists of either tightening cables and cards or locating and replacing failed components. However, if you don't have the time, the computer knowledge, and the inclination to figure out and fix problems yourself, on-site service contracts are your best bet. ■

troller made by NDC and uses standard MFM drive encoding. You can choose either a 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive as drive A:, one of CPU's nice touches. The \$2,272 machine uses a Seagate ST 251-1 40MB hard disk with 28-millisecond access, though the test unit came with a faster 23-ms. Toshiba 40MB disk, an \$85 upgrade. Disk caching software from Polytron is standard. The

Hi-Tek keyboard is the usual, slightly dead, 101-key Enhanced unit from that vendor. The cable is an ample 84 inches long.

Another nice touch is the delayed-response reset switch on the front of the case. Having a reset switch is a significant convenience, but there is justifiable concern about hitting it by accident and thus losing work or data. The CPU 286/12's switch must be pressed for at least 1½ seconds to activate a system reset—a small point but a great idea. CPU also uses a Dallas 10-year system battery rather than the typical lithium type, which usually will last just a year or two.

Computer Products United gives the standard 1-year parts-and-labor warranty on this system, with 18 months on the motherboard and a 30-day money-back guarantee. One significant drawback is the limited FCC Class A rating, meaning that the CPU 286/12 is approved for use in the office but not for home use.

This box fits all the qualifications as a 12-MHz AT clone in features, performance, and price, but CPU goes further with the small touches like the disk caching software, delayed-response reset switch, 10-year battery, money-back guarantee, and 80-ns. memory chips. If you're trying to choose among mail-order machines, don't pass over the CPU 286/12 lightly. Consider these features as well as the thought behind them: the CPU developers didn't need to include the extras, but they did. That counts.



FACT FILE

CPU 286/12

Computer Products United, 12903 Scheerburn Ave., Irwindale, CA 91706; (800) 824-2936, (618) 338-6959.

List Price: With 512K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, \$695; with 1MB RAM, 40MB 28-ms. hard disk, VGA monitor, DOS 4.01, \$2,272; with 40MB 23-ms. hard disk, \$2,359.

In Short: Computer Products United's CPU 286/12 is a straight AT-clone mail-order system with no surprises. Memory expandable to 4MB without buying an extra card is a good deal, as is the 18-month warranty on the motherboard.

CIRCLE 400 ON READER SERVICE CARD

DESTINY COMPUTERS

Destiny 286

by MITT JONES

Destiny Computers seems bent on bringing the no-holds-barred, bargain-basement mentality to the retail market. Though it sells its brand of computers only through dealers, this company is all too eager to stress that a Destiny machine can be built any way you like it, and for only \$875 in its 512K base configuration.

Case in point: We received two 12-MHz Destiny 286 machines for this round-up. The two systems, both labelled only Destiny 286, seemed identical until we slid off the chassis covers. A look inside turned up two different motherboards based on two different chip sets and running two different brands of BIOS. When I called to determine which of the two machines the company would like to submit for review, the spokesman seemed to have a hard time deciding. He did, however, ask what type of keyboard I prefer, boasting that the company carries seven different makes.

Is there anything inherently wrong with this approach? Well, yes. Adequately supporting one motherboard per model presents enough of a challenge, especially when you're throwing in one of a half-dozen varieties of each component. And maintaining accurate, helpful documentation is nearly impossible when one machine can be so different from the next.

With that caveat out of the way, it's safe to point out the raw value and performance the Destiny machines offer. If you're looking for a fast, feature-packed, low-cost machine you can specify virtually component by component, your closest Destiny dealer can help you.

The machine Destiny Computers selected for review uses a motherboard nearly identical to that of the MultiMicro 286/12 (also reviewed here), both in layout and features. MultiMicro reported its motherboard maker as VIP, while Destiny reported first that its board was made by NIC—the name printed on the motherboard documentation—and then maintained it was Sigma Designs. Judging by their nearly identical layouts and their common use of the Suntac chip sets, it seems likely that both motherboards are based on one design, licensed (possibly by Suntac) to several manufacturers.

Regardless, the motherboard in the Destiny 286 ranks among the fastest

Destiny 286

The bare-bones 512K RAM Destiny 286 offers five drive bays (two mount vertically) for only \$875. Our standard 40MB hard disk configuration lists at \$2,610.



around. It boasts an abundance of features, including a rechargeable nickel cadmium battery, jumper-selectable wait states (zero or one), LIM EMS 4.0 emulation capability (with the help of an included driver), and memory sockets designed to accept 256-kilobit or 1-megabit chips for a motherboard total of up to 4MB. Our evaluation unit came outfitted with one 18-socket bank of 100-nanosecond 1-megabit chips, for a total of 2MB of RAM. The ROM BIOS was Award.

A Genoa 16-bit VGA adapter and Adaptec ESDI floppy/hard disk controller occupied two of the six 16-bit slots in our evaluation unit. The 200-watt power supply provides four leads, two of which powered the TEAC 1.2MB 5¼-inch floppy disk drive and 18-millisecond, 90MB

hard disk from CDC. Including the Relisys VGA monitor and DOS 3.3, our evaluation unit would list at \$3,533—a good price considering the high-performance equipment provided.

The 7- by 14½- by 16-inch (HWD) small-footprint case can accommodate five half-height drives: stacked horizontal bays make room for three full-size drives, while brackets on each side of the bays accommodate two 3½-inch drives mounted on their sides. The three horizontal bays and one of the side-mount brackets provide front-panel access. The case won't win any awards for solid design, but it fits together well.

Front-panel features include a system clock, hard disk indicator, turbo button and indicator, reset button, and power button and indicator. The turbo button toggles processor speed between 12 and 6 MHz. Our tests verified the corresponding bus speeds of 8 and 6 MHz.

Documentation supplied with the machine comprised the motherboard manual—meant more for system designers than end users—and the original manuals for the Genoa and Adaptec adapters and CDC hard disk.

While testing this machine, I accidentally turned on the machine numerous times while digging around inside the chassis by bumping the keyboard into the power button. The button is sufficiently recessed when in the *on* position to avoid accidental contact, but I'd rather not have my machine turn on or off without my express consent.

My only other complaint concerns the Genoa adapters supplied in each machine. On one board, the crystal sat so loosely in

its socket that it could be moved with a slight touch; it arrived halfway out of the socket. In the second Destiny 286, the same crystal had been affixed to its socket with a rather large blob of white plastic-like material.

If you buy the Destiny 286, you will undoubtedly get a fast, feature-packed machine at a very low price. You'll also have the pleasure of configuring the machine with the components you like or trust most. Be forewarned, however, that this machine will not offer you the security of gentle documentation, beefy construction, or even support personnel who are necessarily well acquainted with your particular equipment.

ESD COMPUTERS INC.

ESD Series 2000

by Bruce Brown

The ESD Series 2000 in its tested configuration is better left on the shelf. The unit performs well, with good comparative numbers on most of our benchmark tests. But the relatively high price for this little-known computer ignores the reason dealers sell clones and users buy them: clones are supposed to cost a lot less than bigger brand names. The \$1,460 list price for a 512K one-floppy-disk-drive system with one parallel and one serial port is about \$500 more expensive than its competitors. The tested configuration, with 1MB RAM, 43MB hard disk, VGA adapter and monitor, and DOS 3.3, costs \$3,268—roughly \$1,000 more than the machines you can get from most mail-order houses. Sure the ESD computer costs less than IBM, Compaq, Hewlett-Packard, or Wyse computers, but those machines aren't its competition.

The second major issue is quality control, both in terms of the initial designing and checking the units that go out the door. The problems we observed may just be a factor with the system case in the test unit, a full-sized desktop unit that holds only four drives. Because of the location of the drive bays (further to the left than usual), the hard disk they held pushed against the half-length-drive controller card in the back of the machine. The pressure bent a fairly flimsy vertical drive support, so the disk drive was left hanging diagonally in the case. An end user who had the same configuration and didn't open the case



FACT FILE

Destiny 286

Destiny Computers, 754 Whitney St., San Leandro, CA 94577; (800) 366-4272, (415) 430-8810.

List Price: With 512K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, \$875; with 1MB RAM, 40MB hard disk, VGA monitor, DOS 3.3, \$2,610; with 2MB RAM, 90MB hard disk, \$3,533.

In Short: A fast, feature-loaded, bargain-basement machine that sells through dealers only and comes in many different configurations. Problems included minimal documentation and faulty VGA adapters.

CIRCLE 401 ON READER SERVICE CARD



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ESD Series 2000

The ESD Series 2000 costs \$3,268 for our tested configuration. The hard disk in our test unit bent a support strut because the drive fit too tightly.



of the space problem. The two bays on the right accept removable media. ESD's NDC controller (with ST-506 interface and MFH encoding) manages up to two hard and two floppy disk drives. Disk caching software is not included.

Fujitsu makes the 101-key Enhanced-style keyboard, which has a reasonably good clicky feel. The keyboard has indicator lights for CapsLock, NumLock, and ScrollLock on the keys themselves, not on a separate indicator panel as is more standard. The keyboard cable is a generous 108 inches long.

The ESD Series 2000's processor is rated at 12 MHz but runs at 11.9; the chip pauses briefly to refresh memory for compatibility's sake. There is no slow mode. The expansion bus runs the six 16-bit and two 8-bit slots at 8 MHz. One 8-bit slot and one 16-bit slot can take only half-length expansion cards.

ESD makes its own motherboards using VLSI Technologies 286 chips and Phoenix BIOS. Memory can be set for either zero or one wait state, with zero wait states the factory-set default. You can fit up to 1MB on the motherboard; if you want to go higher you must buy a memory expansion board. The most-competitive clones let you replace the 256-kilobit RAM chips with 1-megabit chips to get 4MB without an add-on board. ESD does not use memory interleaving or shadow RAM or video BIOS on this machine. Even though the system clock runs a bit below 12 MHz and there are no speed-up memory schemes, the Series 2000 scored better than average on the processor and conventional memory benchmark tests.

There is a reset switch on the front of the machine, along with power, hard drive access, and turbo-mode lights. Since this machine always runs in turbo mode (11.9-

MHz, in this case), the indicator is superfluous.

ESD provides a standard 1-year warranty on parts and labor, with service provided through dealers. There is a small technical support staff at ESD, but the dealer is the preferred avenue for technical help.

In sum, the ESD Series 2000 costs too much for what it offers. The performance scores are impressive, but they're not enough to make up for poor design and a high price tag. ESD sells other 286 machines that may be better buys, but there's no good reason to go with this one.

EVEREX SYSTEMS INC.

Everex Step 286-12

by Mitt Jones

Though by no means the least-expensive machine in this roundup, the Everex Step 286-12 ranks near the top when it comes to value per dollar. Add up zero-wait-state performance, better-than-average construction, a generally thoughtful design, DOS 3.3, GW-BASIC, and 1 year of on-site service, and suddenly the \$2,299 base-configuration list price begins to look like a bargain.

The Step 286-12 also offers one advantage no other machine here can boast: its very own 386SX upgrade kit—optional, of course. The proprietary upgrade won't raise your system's clock speed, but it will allow you to take advantage of 386-specific software. One word of caution: by the time you add the \$699 price of the upgrade kit to the price of the machine, you're paying about what you would for a similarly positioned 16-MHz 386SX. It's a comfort to know the upgrade is there, but if you think you'll really buy it you should opt for a 386SX machine from the start.

The Step 286-12 boasts one of the most useful arrays of front-panel controls I've ever had the pleasure of tinkering with. My favorite of the bunch is an inconspicuous little button that lets you disable the system speaker at will. More useful and only slightly less interesting, a three-position speed switch allows you to toggle between 12 MHz at the top setting and 4 MHz at the bottom. The middle setting enables using the keyboard to select 12, 6, or 4 MHz, and an indicator light for each helps you keep track of the changes. A reset button, a power indicator, and a hard disk access

might not have realized the problem for months, or perhaps not at all, but the odds are fairly strong that there would have been problems with the drive, since hard disks run best when mounted horizontally or vertically, not diagonally. The test machine also had a loose front panel; support pieces were partially broken.

The ESD Series 2000 case measures 6.5 by 19.5 by 16.5 inches (HWD). The tested configuration had 1MB of 100-nanosecond RAM, a MicroScience 43MB hard disk, a Video Seven 16-bit VGA card, and a Tating VGA monitor. The 200-watt power supply has four leads, which is fine for the four drive bays, assuming you can fit four drives by judiciously placing the drive controller somewhere other than the normal slot because

PC

FACT FILE

ESD Series 2000
ESD Computers Inc., 10620 Rockledge, #200,
Houston, TX 77089, (713) 530-5671.
List Price: With 512K RAM, 1.2MB 5 1/4-inch
floppy disk drive, \$1,460, with 1MB RAM, 43MB
hard disk, VGA monitor, DOS 3.3, \$3,268.
In Short: The ESD Series 2000 has the standard
features for a 12-MHz 286 machine, but the price
is too high for a lesser name. Quality control and
design are less than outstanding.

CIRCLE 422 ON READER SERVICE CARD

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CIRCLE 320 ON READER SERVICE CARD

BENCHMARK TESTS: 12-MHz 286 PCs

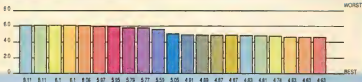
The Destiny 286, MIT Systems 286-12, and MultiMicro 286/12 share the fastest times on our processor tests. In fact, whatever other problems it may have, the MultiMicro emerges with the fastest timings overall.

The Compaq Deskpro 286e has some of the slowest processor speeds, but its video scores are lightning-fast; in this respect only the Mitsubishi MP286 comes close.

PROCESSOR AND MEMORY BENCHMARK TESTS

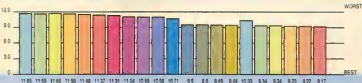
80286 Instruction Mix

The **60286 instruction Mix** benchmark test times a series of tasks specific to the 60286 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



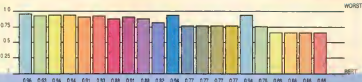
Floating-Point Calculation Without Coprocessor

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then axeses the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory

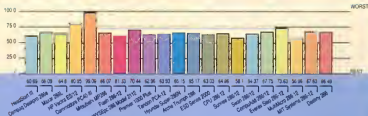
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

DOS File Access (Small Records)

The **DOS File Access (Small Records)** benchmark tests disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



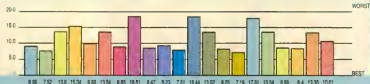


BENCHMARK TESTS: 12-MHz 286 PCs

DOS File Access (Large Records)

Elapsed Time (seconds)

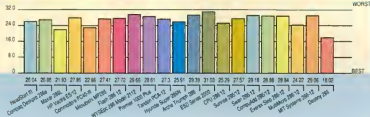
The **DOS File Access (Large Records)** benchmark tests disk throughput as a result of mechanical track-to-track disk drive access speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

Elapsed Time (seconds)

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.

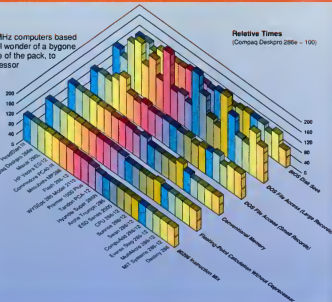


PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

There are no major surprises among these 12-MHz computers based on the 80286 microprocessor—the technological wonder of a bygone year. From the Arce Triumph 286, in the middle of the pack, to the Destiny 286, which came in first on our processor tests, the last ten listed machines represent the best test handlers in this roundup.

On the basis of numbers alone, the bargain-basement-priced MultiMicro 286/12 is the leading machine overall, scoring among the top five on each test. Speedy performance, however, should not blind the buyer to possible problems with the unit's construction and customer support.

Some performance handicaps could be overcome by changing the configuration. A faster hard disk would be a quick fix for some of the mail-order systems—the Swan 286/12, MultiMicro 286-12, and CompuAdd 286/12—although the Swan's slow Conventional Memory access is a factor to beware. Unfortunately, increasing the prices of these systems by adding faster components places you on the doorstep of the 80386SX world without the benefits of multitasking technology.

Relative Times
(Compaq Designpro 286-12 = 100)

CONTINUES



Standard PowerFlex Features:



The powerful 40 Mb embedded hard disk provides storage for approximately 20,000 pages of documentation.



Racing at 12.5 Mhz, the new 286-based PowerFlex from ALR runs circles around the 8MHz competition. Just check out the Mips chart on the next page.

One megabyte of main memory with built-in hardware EMS 4.0, you can



immediately break the 640K barrier to run all your memory intensive spreadsheets and other applications.

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But what really sets the PowerFlex apart from other 286 based systems is the one standard feature that is far from standard. Immediate upgradability to 386SX® and soon i486® technology. This assures that as your application needs change, your PowerFlex can change with them.

So to get more information on this remarkable PC and the name of your closest ALR authorized reseller please call;

1-800-444-4ALR

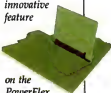


The 386SX® PowerFlex Module, available now, offers true 386-based processing to run all 386-based applications. At \$395, this upgrade to 386 technology is a savings of over \$3,100 when compared to Compaq's® Deskpro® 386s model 40.

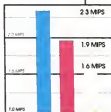
Advanced Logic Research, Inc.
9401 Jeronimo Irvine, CA 92718
(714) 581-6770 FAX: (714) 581-9240

For our Canadian office:
1-800-443-4CAN
For our UK office:
0 635-521 922
FAX: 0 635-521 844
For our Singapore office:
(65) 258-1286
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The 386/i486 connector is the most innovative feature



on the PowerFlex. You can upgrade to 386® technology today and soon i486® technology. It's your guarantee that what you buy today won't be obsolete tomorrow.



Performance is based on the ratings of CPU/Memory in Million Instructions per second (MIPS) Source: Power Bench™ version 1.5. The Core-Bench Group, Inc. (Spartan, CA)

ALR PowerFlex with 386SX Module
ALR PowerFlex
AST Bravo/286

ALR PowerFlex		AST Bravo/286	
12 MHz 80286 1Mb RAM 0-Wait State Paged 1.44 Mb Floppy Drive 6 Expansion Slots 4 Internal Drive Bays		8 MHz 80286 512 Kb RAM 0-Wait State 1.2 Mb Floppy Drive 3 Expansion Slots 2 Internal Drive Bays	
		\$1245	Model 5
40 Mb hard Disk PowerFlex 386/i486 Conn. Hardware w/ EMS 4.0	incl. incl.	\$850 N/A- \$895	40 Mb hard Disk Not Available Hardware w/ EMS 4.0-using Rampage® Plus 286 with 512K
\$1495		\$2990	

Prices and configurations are as of June 1989 and are subject to change without notice. Verify with manufacturer. Shown with optional monitor.

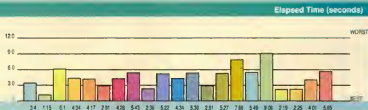


BENCHMARK TESTS: 12-MHz 286 PCs

VIDEO BENCHMARK TESTS

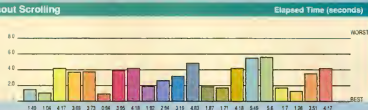
Direct to Screen

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



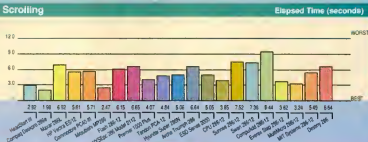
Video BIOS Routine Without Scrolling

The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



Video BIOS Routine with Scrolling

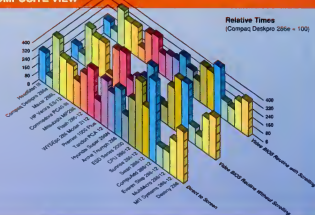
The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



VIDEO BENCHMARK TESTS: COMPOSITE VIEW

The Compaq Deskpro 286e and Mitsubishi MP286 scored the highest for video performance. The Compaq's built-in, 16-bit VGA circuitry and the Mitsubishi's Video Seven adapter account for their strong showings.

As with the hard disks, the mail-order machines would benefit from the substitution of faster, 16-bit video adapters for the standard 8-bit cards. This option is readily available but adds to the overall system cost.



Everex Step 286-12

The Everex Step 286-12 tucks away its turbo, reset, and speaker switches behind a panel in the front of the box. Our test-configuration VGA system costs \$3,499.



light, as well as one of those NBVU (Neat But Virtually Useless) 8-character information panels, round out the collection. Last but not least, a see-through, smoke-tinted plastic door slides over the control panel to guard against accidental resets.

With its cover off, the Step 286-12 looks a lot like a good old IBM AT, meaning you shouldn't have a problem finding replacement parts that fit. Everex sent the 6½- by 17½- by 16½-inch small-footprint model for evaluation, but a full-size version is also available. Aside from size, the only real difference is the number of drive bays: the small-footprint chassis accommodates three half-height drives, while the full-size chassis makes room for five.

The Everex motherboard sports an Intel 12-MHz 286, an AMI ROM BIOS, and a

chip set that is all Everex but for one Chips and Technologies DMA controller. Two banks of memory sockets, designed to accept either 256-kilobit or 1-megabit DIPs, allow motherboard memory expansion up to 4MB. Though spec'd for 80-nanosecond chips, our machine came with 100-ns. 256-kilobit chips. Everex assured us that the chips had been adequately tested via factory burn-in to ensure proper zero-wait-state operation.

In addition to the usual collection of AT switches, you'll find a couple of system-board options most vendors don't give you. First, a jumper lets you slow the system down by adding a system-wide wait state. In the full-size chassis, the positioning of the jumper makes it impossible to set, so you'll have to specify the setting before your computer leaves the factory.

Next, to help ensure I/O adapter compatibility, Everex allows you set I/O bus wait states; in addition, it runs the bus at a top speed of 6 MHz. One motherboard switch allows from zero to two wait states for the six 16-bit slots, and another allows from three to five for the two 8-bit slots. The default settings are one and four.

The Everex documentation was another pleasant surprise. The team that designed and wrote it should be captured and put to work rewriting documentation nationwide. Nicely bound and wonderfully illustrated, the 200-page manual pulls off the difficult task of telling both the new user and old pro what they need to know without bogging either one down.

The Step 286-12 comes with a RAM-disk program and, like many other machines in this roundup, a relabeled version of PC-Kwik disk-caching software.

This machine's only real drawback may be a few rather obscure components. Everex designs a good number of the com-

ponents itself, and the company is busy designing components to replace most others, but in the meantime you'll have to live with a lesser-known name or two. For instance, the Everex-labeled VGA monitor is supplied by Calcomp, and Maxilogic (wholly owned by Everex) manufactures the Paradise-based VGA adapter. None of these components was obviously inferior; the Maxilogic VGA performed especially well.

A 40MB 28-millisecond Seagate drive, a TEAC 1.2MB 5¼-inch floppy disk drive, and the Everex "Magic I/O" I/O adapter rounded out the equipment in our evaluation unit.

All in all, the Step 286 packs plenty of features and quality into a reasonably priced and extremely fast package. If you fancy the raw speed and nuts-and-bolts versatility of some of the lower-priced machines but you also want the solid backing of a company that's been around, this machine may be just what your desktop needs.

HEADSTART TECHNOLOGIES CO.

HeadStart III

by Bruce Brown

Package deals are great if you want everything that is supplied in the package. The widely advertised HeadStart III comes with lots of brand-name software and many standard features—though not, as you might believe from reading the ads, a monitor. Users who don't want to choose their own hardware and software components might be relieved by HeadStart Technologies' doing the job for them. More-knowledgeable users will choose a different combination.

The HeadStart III is sold by HeadStart Technologies Co.; the company name was Vendex before it was purchased by North American Philips. The base system, without a monitor, costs \$2,995. This price is usually missing from the otherwise descriptive ads. If you want to add HeadStart's VGA monitor for \$795, the full system price is \$3,790—enough reason to pause and analyze what you get for the money.

The HeadStart III system includes 1MB of RAM on a motherboard that uses Intel 286 chips, a proprietary version of the Award Software BIOS, and an 80286-12 processor. The processor runs at either 8 or

PC FACT FILE

Everex Step 286-12
 Everex Systems Inc., 46431 Milmont Dr.,
 Fremont, CA 94538, (800) 356-4283, (415) 683-2211
 List Price: With 1MB RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, DOS 3.3, GW-BASIC 3.2, \$2,999; with 40MB hard disk, VGA monitor, \$3,499
 In Short: A high-performance, high-quality system that comes with excellent documentation and 1 year of on-site service

CIRCLE 409 ON READER SERVICE CARD

HeadStart III

The HeadStart III is a pricey \$3,790 with 1MB of RAM, a 32MB hard disk, a VGA monitor, and software. Its three drive bays are full, and expansion is limited.



take up much desk space, roughly following the design profile of IBM's PS/2 systems. Inside the box you discover a departure from the PS/2's easy-to-take-apart design. While PS/2s are short because they are designed for short MCA add-on cards, the HeadStart III is short because it holds the more-standard but taller AT bus cards horizontally. These cards fit horizontally into an unusual treelike expansion bus, similar if not identical to that used in the Maxar 286L (also reviewed here).

Both 8- and 16-bit full-length expansion cards fit into the left side of the expansion tree. The right side of the tree—populated in the HeadStart with standard-feature cards for video, hard disk controller, I/O, and memory expansion—has three half-length 16-bit slots. As long as you never have to take out the expansion tree, this system is probably fine, but (as with the Maxar) once you loosen all the parts necessary to take out even one of the cards on the right side of the bus, you may have trouble putting everything back together correctly.

The HeadStart III ads give the impression that you can add 2MB of RAM to the motherboard without purchasing another card. This is literally accurate, because the stock I/O card for the mouse and game port has room for 2MB of memory chips. If you want more than 3MB, of course, you'll have to buy a card. Memory runs at one wait state, with no memory interleaving. This system does not have shadow RAM or video BIOS.

If you like the HeadStart III as it is and won't outgrow the hard disk, then you have a machine with three slots for extra goodies, such as a modem card or extra memory expansion cards, should you need them in the future. Add a monitor, a cable,

and a printer and you're all set.

I probably wouldn't have chosen the mix of software HeadStart Technologies has bundled with this system, but there's a lot here, and it's all good. The broad base is *Framework II*. This integrated software package isn't the most recent edition (Ashton-Tate currently sells *Framework III*), but for years many people were happy with *Framework II*'s word processing, spreadsheet, and telecommunications modules.

The HeadStart III mix also includes *3-D Perspectives Graphics*, a Windows-like Advanced Operating Environment,

**The HeadStart III
holds expansion cards
horizontally in an
unusual treelike
expansion bus that
proves difficult to
reassemble correctly.**

Splash, Publish-It!, several utility programs (including the respected *XTree* drive- and file-management program), and one game, *Chessmaster 2000*. ATI tutorial software to help you figure out how to use the computer and DOS 3.3 is included as well. If you don't have many computer books on your shelves, the documentation that comes with all this software will get you off to a good start.

One of the more-exciting features of the HeadStart III is the 18-month parts-and-labor warranty, with on-site service provided by Harris, a nationwide service chain.

A perplexing note concerns the HeadStart III's FCC rating. The case is marked with a Class A certification, meaning that you're not supposed to use this machine at home. If the FCC rating doesn't change, it's hard to recommend the HeadStart III for any use. You can't use it at home and it isn't enough computer for business use. Businesspeople are also less likely than home users to use the bundled software, which makes the HeadStart III an even more chancy deal. Bundling makes for impressive ads, but this is one case where it doesn't pay.

12 MHz, while expansion boards are accessed at 8 MHz. Standard drives include a 32MB hard disk and both 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drives. Including both flavors of floppy disk drives is a sensible, aggravation-freeing move, but HeadStart obviously expects that you will be satisfied with the provided drives, including the hard disk, since there are no vacant drive bays.

Other standard features include two serial ports, one parallel port, a mouse port, a game port, 16-bit VGA graphics, and a 1:1 interleave Western Digital hard disk controller. A 101-key keyboard with an 84-inch cable and relatively dull feel completes the hardware package.

The HeadStart III's system box, 4.25 by 16 by 16.25 inches (HWD), doesn't

FACT FILE

HeadStart III
HeadStart Technologies Co., 40 Cutter Mill Rd., #438, Great Neck, NY 11021; (800) 882-1888.
List Price: With 1MB RAM, 32MB hard disk, 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drives, DOS 3.3, GW-BASIC, \$2,995; with VGA monitor, \$3,790.

In Short: If you can use all the software included, the HeadStart III is a great deal. Otherwise, this average-performing, limited-expandability PC costs too much. Not certified for home use.

CIRCLE 404 ON READER SERVICE CARD

Call For
Corporate Evaluation Kit,
Including Board and 256K Upgrade



TODAY TOMORROW YESTERDAY

Today, you need VGA. Or maybe Extended VGA.
Quadram believes you deserve more.

1024 × 768

Why settle for mere VGA? Or even Extended VGA? The 256K Spectra gives you 64 colors at a resolution of 800 × 600. And, with expansion to 512K, sixteen colors at the new graphics standard of tomorrow, 1024 × 768. QuadVGA Spectra has the flexibility and power to enhance both 8-bit machines and 286/386 systems.

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Naturally, QuadVGA Spectra is register-level compatible with all accepted modes from Extended VGA down to MDA. That means you can use yesterday's software as well as today's and tomorrow's.

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Quadram was in the graphics business back when screens were monochrome. And, we've provided our customers with a solid product in every mode that has evolved since. In fact, our QuadEGA+ and ProSync led the color revolution and are still popular boards. We understand graphics.

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The award-winning graphical word processing software for DOS users with Mac Envy.

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Trademark Owners: Quadram, the Quadram logo, QuadEGA+, QuadEGA ProSync, QuadVGA Spectra Quadram, PS/2 IBM.

CIRCLE 191 ON READER SERVICE CARD

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CIRCLE 219 ON READER SERVICE CARD

HEWLETT-PACKARD CO.

HP Vectra ES/12

by Bruce Brown

While Hewlett-Packard's current presence in the personal computer world is due to its laser and ink jet printers and desktop scanners, for 2 years HP has been building a line of standalone computers. Originally HP's microcomputers were used most often in conjunction with its minicomputers, but now the company wants to compete with IBM and Compaq as an alternate high-end PC vendor. The HP Vectra ES/12, Hewlett-Packard's 12-MHz 286 computer, is a respectable machine, but its performance and pricing are not yet competitive.

The Vectra ES/12 starts with a base model for \$2,495, including 640K RAM, a choice of a 1.2MB 5¼-inch or a 1.44MB 3½-inch floppy disk drive, one parallel and one serial port, and a keyboard. The base model comes with an HP Human Interface Link port and Terminal Emulation software (for the HP minicomputer, so

card. That card can hold additional memory chips as well, to a maximum of 8MB, but the initial increment is crazy for anyone who merely wants a 1MB system.

Thus, the ES/12 VGA system with a 40MB drive and 2.6MB costs \$6,105, which makes even the Compaq look like a bargain. At that price it makes sense to consider buying a 386-based computer. HP's conception may be that users fall into two groups, wanting either a mere 640K or a great deal more memory. That doesn't jive with market perceptions in general. The bottom line is that the Vectra comes across as either underpowered or too expensive. Neither image helps its cause.

The Vectra ES/12's performance is ad-

equated for this class of machine. Because of compatibility-minded memory-refresh cycles the system runs at only 11.6 MHz, not the full 12 MHz; and this difference, though minor in real-life applications, relegates the ES/12's scores to the lower end of the field.

The ES/12's small-format case measures 6.5 by 16.75 by 15.5 inches (HWD). There are three half-height drive bays, with two available for removable media. The 176-watt power supply has three power leads. In all, there are eight expansion slots, but only seven are standard slots—five 16-bit and two 8-bit. The eighth slot is a proprietary slot for memory expansion, which runs at the full system speed rather than slowing down to the 8-MHz bus speed maintained by the other slots.

Many of the HP's components and features are industry-standard, including a Western Digital ST-506 MFM floppy/hard disk controller, a Chips and Technologies 286 chip set, and a Phoenix-licensed HP-labeled BIOS. The 101-key Enhanced-style keyboard has unusually styled forward-slanting keys. While the keys look a bit odd, their spacing and relative reach is

HP Vectra ES/12

The HP Vectra ES/12 sells for \$4,410 with 640K RAM, a 40MB hard disk, and a VGA monitor. The system accepts a maximum of 8MB of RAM in a special 12-MHz expansion slot.



Hewlett-Packard seems to believe that users fall into two groups, wanting a mere 640K or a great deal more memory. The result is either underpowered or too expensive.

PC

FACT FILE

HP Vectra ES/12
Hewlett-Packard Co., Customer Information Center, Inquiry Fulfillment Dept., 19310 Prunefridge Ave., Cupertino, CA 95014; (800) 752-0900

List Price: With 640K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drives, \$2,495; with 40MB hard disk, VGA monitor, DOS 3.31, \$4,410; with 2.6MB RAM, \$6,105.

In Short: The HP Vectra ES/12 makes it expensive to get more than the standard 640K of RAM, but otherwise this well-built, small-footprint system performs well and is priced as expected. Look for discounts.

CIRCLE 406 ON READER SERVICE CARD

most of us get nothing from it), along with disk caching software and a setup program.

The VGA configuration we tested for this review, with 40MB hard disk, costs \$4,410. And that system still doesn't meet all our requested specifications, for it has only 640K of RAM instead of 1MB, and it has only one serial port. A two-serial expansion card costs \$230, but adding memory is a far more expensive proposition. Unfortunately, the next step up for additional memory is a giant one—increasing to 2.6MB by adding a \$1,695 memory



very good. Unfortunately, the key response is fairly flat. The keyboard cable is a generous 108 inches long. HP uses a Paradise 16-bit VGA card and its own VGA monitor.

The Vectra ES/12 computer is an acceptable machine backed by HP's service network, but it is by no means a speed demon, and it costs too much. If HP wants to compete with IBM and Compaq, the company needs an edge this machine doesn't provide.

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1309	□ MultiMate Advantage II 1.0 ... 299.
Autodesk ... NCP	
4519	□ AutoSketch 2.0 ... 89.
Bible Research ... NCP	
1484	□ The Word 4.2 (KJV or NIV) ... 159.
Bloc Publishing ... NCP	
4796	□ Personal Lawyer 2.0 ... 39.
4801	□ PopDrop 3.1 ... 32.
1447	□ FormTool 2.01 ... 55.
4594	□ Form Filer 2.0 ... 89.
Borland International ... NCP	
1527	□ SuperKey 1.16 ... 69.
1498	□ Turbo C 2.0 ... 99.
4330	□ Turbo C Prof. Pack 1.0 ... 169.
5335	□ Turbo Pascal 5.5 ... 99.
4332	□ Turbo Pascal Prof. Pack 1.0 ... 169.
4329	□ Turbo Assembler & Debugger 1.0 ... 99.



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1521	□ Quattro 1.01 w/SQZ+Plus 1.0 ... 165.
1514	□ Paradox 3.0 ... call
Bourbaki ... NCP	
4524	□ TDIR + 3.02 ... 49.
Bridgeway Publishing ... NCP	
4386	□ FastTrax 3.9 ... 35.
Brightbill-Roberts ... NCP	
5408	□ Hyperpad 1.0 ... 59.
Broderbund ... CP	
1434	□ Print Shop 2.41 ... 39.
1433	□ Memory Mate 3.01R (NCP) ... 45.
Central Point ... NCP	
5039	□ PC Tools Deluxe 5.5 (new version) ... 79.
5038	□ Copy II PC 5.0 ... 27.
Chronos Software ... NCP	
4387	□ Who-What-When 1.09 ... 119.
Computer Associates ... NCP	
4934	□ SuperCalc 5.1.0 ... 319.
Corel Systems ... NCP	
5506	□ Corel Draw 1.02 ... 285.
Crosstalk Communications ... NCP	
2911	□ Remote! 1.1 ... 95.
2908	□ Crosstalk XVI 3.7 ... 95.
2909	□ Crosstalk MK.4 1.1 ... 124.
DacEasy ... NCP	
3208	□ Lightning 4.82 ... 39.
1754	□ Dac Easy Light 1.0 ... 42.
1756	□ Dac Easy Payroll 3.0 ... 59.
1748	□ Dac Easy Accounting 3.0 ... 59.
3209	□ Lucid 3-D 2.0 ... 59.
Data Storm ... NCP	
4798	□ PROCOMM PLUS 1.1B ... 45.
Delrina Technology ... NCP	
4325	□ PerFORM 2.0 (new version) ... 179.
5th Generation ... NCP	
3950	□ Fastback Plus 2.09 ... 109.
Fox Software ... NCP	
2233	□ Foxbase Plus 2.1 (single user) ... 199.
Foundation Ware ... NCP	
5505	□ Certus 1.0 ... 99.
FunK Software ... NCP	
2228	□ Sideways 3.21 ... 42.

2229	□ Worksheet Utilities 1.0 ... \$59.
4479	□ Allways 1.0 ... 85.
5157	□ Allways for Symphony 1.0 ... 85.
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Great American Software ... NCP	
4880	□ The Accounting System 2.0 ... 179.
4879	□ Payroll 2.05 ... 89.
5159	□ Master Module 2.05 ... 89.
Harvard Associates ... NCP	
2324	□ PC Logo 3.0 ... 59.
Hayes ... NCP	
2293	□ Smartcom II 3.0 ... 89.
2295	□ Smartcom III 1.0 ... 149.
Hilgreave Software ... NCP	
2323	□ HyperACCESS 4.0 ... 115.
Individual Software ... NCP	
2415	□ Typing Instructor Encore 2.13 ... 19.
2408	□ Professor DOS 2.51 ... 27.
Intuit ... NCP	
2426	□ Quicken 3.0 ... 35.
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5191	□ Ronstadt's Financials 1.01 ... 125.
Lotus ... NCP	
5417	□ 1-2-3 3.0 ... call
5134	□ Magellan 1.0 ... 99.
4131	□ Agenda 1.0 ... 275.
2660	□ Freelance Plus 3.0 ... 345.
2667	□ Symphony 2.0 ... 459.
MECA ... NCP	
4529	□ Checkwrite Plus 1.0 ... 29.
2798	□ Managing Your Money 5.0 ... 119.
Microcom ... NCP	
2775	□ CarbonCopy Plus 5.0 (2 req.) ... 115.
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2860 □ **Learning DOS 2.0** ... 35.

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2900 □ **Windows 386 2.1** ... 129.

2890 □ **Multiplan 4.01** ... 135.

2901 □ **Word 5.0** ... 209.

2856 □ **Excel 2.1** (req. 80286/80386) ... 239.

2891 □ **Project 4.0** ... 329.

LANGUAGES

5188 □ **QuickPascal 1.0** ... 69.

2894 □ **QuickBASIC 4.5** ... 69.

2895 □ **QuickC 2.0** ... 69.

5410 □ **QuickC 2.01 w/Assembler** ... 139.

2880 □ **Macro Assembler 5.1** ... 99.

2847 □ **Basic Compiler 6.0** ... 199.

2859 □ **Fortran Compiler 5.0** ... 289.

2853 □ **C Compiler 5.1** ... 299.

Monogram ... NCP

2778 □ **Dollars and Sense 3.1** ... 105.

Multisoft ... NCP

4924 □ **Super PC-Kwik 3.2** ... 49.

4925 □ **PC Kwik Power Pak 1.3** ... 79.

Nentucket Software ... NCP

2970 □ **Clipper** (Summer '87) ... 429.

New England Software ... NCP

3004 □ **Graph-in-the-Box 2.2** ... 75.

4337 □ **GB-Stat 1.5** ... 159.

4336 □ **GB Analytic 1.0** ... 105.

Nolo Press ... NCP

2982 □ **WILLMAKER 3.0** ... 35.

5122 □ **For The Record 1.0** ... 35.

North Edge Software ... NCP

2967 □ **Timeslips III 3.3** ... 169.

Norton-Lambert ... NCP

4928 □ **Close-Up Customer 3.0** ... 135.

4926 □ **Close-Up Support 3.0** ... 165.

On Track Computer Sys. ... NCP

5490 □ **Disk Manager 4.0** ... 65.

Owl International ... NCP

3080 □ **Guide 2.0** ... \$143.

Paperback Software ... NCP

3142 □ **CVP-Planner Plus 2.0** ... 145.

3138 □ **CVP-Expert 2.02** ... 145.

Paul Mace ... NCP

2762 □ **Mac Utilities 5.0** (DOS utilities) ... 55.

4688 □ **Mace Gold 1.0** ... 79.

Personics ... NCP

3126 □ **SeeMORE 2.0** ... 54.

4328 □ **Look & Link 1.04** ... 59.

4384 □ **Ultravision 1.2** ... 79.

3124 □ **ATBASE 1.22** ... 119.

Peter Norton ... NCP

3152 □ **Norton Commander 2.0** ... 52.

3146 □ **Advanced Utilities 4.5** ... 89.

3153 □ **Norton Editor 1.3** ... 45.

4150 □ **Dan Bricklin's Demo Prog. 2.1.0** ... 109.

Quarterdeck ... NCP

3221 □ **Expanded Memory Mgr. 386 4.2** ... 39.

3220 □ **DESOView 2.24** ... 79.

4586 □ **DESOView 386 1.0** ... 115.

Reference Software ... NCP

4396 □ **Grammatik III 1.1** ... 52.

Revolution Software ... NCP

4480 □ **VGA Dimmer 2.01** (screen saver) ... 19.

3254 □ **Cruise Control 3.02** ... 39.

Rightsoft ... NCP

4155 □ **Rightwriter 3.1** ... 54.

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5148 □ **Am! 1.0A** ... 129.

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3314 □ **Typing Tutor IV 1.0** ... 33.

Softlogic Solutions ... NCP

3546 □ **Disk Optimizer 4.01** ... 45.

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4441 □ **Resume Kit 1.29** ... 25.

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3425 □ **Q & A 3.0** ... 219.

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5179 □ **LapLink III** ... 85.

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3561 □ **True BASIC 2.1** ... 52.

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1302	SixPakPlus 64k C/S/P	129.
4107	RAMpage Plus 286 512k	419.
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1681	Curtis Clip CC-1	6.

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1713	Filtered SafeStrip SPF-3	24.
1678	Universal System Stand SS-3	25.
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2304	Smartmodem 1200	289.
2305	Smartmodem 1200B (w/Smartcom II)	289.
2306	Smartmodem 1200B (hardware only)	258.
2307	Smartmodem 2400	429.
2308	Smartmodem 2400B (w/Smartcom II)	429.
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4266 Above Board Plus 512k ...	419.
4267 Above Board Plus I/O 512k ...	449.
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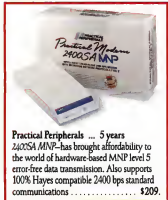
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HYUNDAI ELECTRONICS AMERICA

Hyundai Super-286N

by Bruce Brown

Hyundai, the Korean car manufacturer, was enviably successful in marketing low-priced, quality cars. In just a few years, Hyundai became a recognized and respected brand name. Recently the company has started to sell more-expensive cars, attempting to cash in on that reputation. Now Hyundai is trying to become a major player in the personal computer market, but this time it's skipping the low-cost step that worked so well with automobiles.

Originally the OEM of the inexpensive Blue Chip line of clones, Hyundai has begun selling computers under its own name. It may find that starting with relatively high-priced machines doesn't work well, especially in the competitive 286 clone market.

The Hyundai Super-286N lists for \$1,595 in its basic configuration, including 1MB of RAM, a 1.2MB 5¼-inch floppy disk drive, one serial port, one parallel port, DOS 3.3, GW-BASIC, and diagnos-

The Super-286N uses a Hyundai-manufactured motherboard with a Chips and Technologies 286 chip set and a special version of Award Software's 286 Modular BIOS. The system clock is keyboard switchable to either 6 or 12 MHz, and the expansion bus runs add-on cards at a very safe 6 MHz. Overall the Super-286N is a pretty fast 286, especially on the large-record DOS File Access test.

The standard 1MB of on-board memory can be increased to 4MB by switching to 1-megabit chips instead of the standard 256-kilobit chips. Depending on the memory chip speed, memory runs at either zero or .5 wait states. The test version had 120-nanosecond memory chips (the slowest you should use) and ran at .5 wait states—which isn't an actual speed but an equivalent result based on Hyundai's use of interleaved memory, a performance enhancement technique.

The Super-286N also employs shadow RAM and video, speeding access to the instructions the computer would normally have to retrieve at speeds limited by system clock or expansion bus speeds. Another performance and convenience feature is built-in support for LIM 4.0 expanded memory.

The Super-286N uses a Hyundai drive controller on-board to operate up to two floppy disk drives. The Connor CP-344 40MB hard disk has its own SCSI controller; another 40MB hard disk can be daisy-chained from the first.

Additional accoutrements include a 200-watt power supply with four power leads, and a Chicony 101-key-style keyboard with a nice feel and an 80-inch cable. Those considering using a 286 computer at home can be assured by the FCC Class B rating.

Hyundai's 18-month parts-and-labor warranty is fulfilled by its dealer network, through which the company now prefers to sell its computers. Hyundai also offers an optional S.O.S. (Service on Site) program. Pricing wasn't set for the 286N's S.O.S. program by press time, but on-site service for the 286C, Hyundai's 10-MHz machine, is \$169.95 for the first 18 months of ownership.

Hyundai is trying to break into the corporate computer world. Its sales literature is top quality, and the way it equips machines, as well as the increasingly requested on-site service option, may well make Hyundai computers palatable to corporate


users. Hyundai intends to compete with computer vendors such as Epson and AST and should have a 386-based computer on the market by the time this review gets into print.

The Hyundai Super-286N is no econobox. While it offers a goodly selection of features and respectable performance, the price is a little surprising. If you have to pay close to \$4,000 for a 40MB 12-MHz 286, especially with only an EGA monitor, you expect a brand name. Hyundai is certainly a recognizable name, but to date it hasn't been associated with this level of pricing. This marketing strategy may work, but I'll bet dealers will need to discount these machines heavily until Hyundai's computers build the following that its automobiles have.

Hyundai Super-286N

The Hyundai Super-286N lists for \$3,439 with 1MB of RAM, a 40MB hard disk, and VGA. The recessed reset switch at the front eliminates accidental reboots.





PC
MAGAZINE

FACT FILE

Hyundai Super-286N
 Hyundai Electronics America, 166 Baypointe
 Pkwy., San Jose, CA 95134; (800) 727-6972,
 (408) 473-9200
 List Price: With 1MB RAM, 1.2MB 5¼-inch
 floppy disk drive, DOS 3.3, GW-BASIC, \$1,595;
 with 40MB hard disk, VGA monitor, \$3,439; with
 1.2MB and 360K 5¼-inch floppy disk drives, EGA
 monitor, \$3,569
 In Short: Hyundai's Super-286N is
 unexceptional but acceptable, with good
 performance at a high price. Look for discounts.

CIRCLE 408 ON READER SERVICE CARD

tic software. The small-size case, 6.25 by 16 by 16.5 inches (HWD), has room for four drives (with three showing) and has seven expansion slots: five 16-bit and two 8-bit.

The test-configuration machine, with a 40MB hard disk (the only hard disk offered with this machine), a 1.2MB 5¼-inch floppy disk drive, a VGA card, and an EGA monitor (Hyundai doesn't sell a VGA monitor yet), costs a whopping \$3,439. One feature on our test machine was an additional 5¼-inch (360K) floppy disk drive—a \$130 option that brought the total list price to \$3,569.

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MAXAR PCs

Maxar 286L

by Bruce Brown

The Maxar 286L is short and it may be sweet—as long as you don't have to take it apart. The 286L's low profile is made possible by an unusual expansion-slot module that holds cards horizontally rather than vertically, as is more common. Other than this unusual internal design feature, which is also seen in the HeadStart III, the Maxar 286L is a straightforward 12-MHz AT clone.

At 4.25 by 16 by 16.25 inches (HWD), the pricing for Maxar starts with a base unit that costs \$1,768, including 1MB of 120-nanosecond RAM, one 1.2MB 5¼-inch floppy disk drive, two serial ports, a parallel port, a game port, and a mouse port. DOS 4.0 and GW-BASIC are also standard. While this relatively bare unit costs more than many of its competitors, the 40MB hard disk system with an Orchid 8-bit VGA card and MaxiScan VGA monitor costs only \$2,295—a better deal than you could probably get yourself by buying

The Maxar 286L has an unusual expansion-slot module that holds the cards horizontally.

those components separately.

The motherboard is manufactured by Hyosung Computers, Maxar's parent company. The motherboard in the test unit was silk-screened with the words "HeadStart III." It turns out that Hyosung also supplies motherboards for HeadStart Technologies. The Maxar uses Award Software ROM BIOS chips and Intel 286 chips.

The Maxar's system clock can run at either 8 or 12 MHz, switchable with a keyboard sequence (Ctrl-Alt and the Plus or Minus key). Switching the system clock speed changes the bus speed as well, though at the higher speed the bus slows down to 8 MHz when components plugged into it are accessed. Because of memory refresh cycles, our measurement

COMPUTERS

12-MHz 286 PCs

showed the Maxar running at 11.6 MHz, not 12 MHz. The Maxar's scores on the benchmark tests were well below average.

The standard 1MB of memory chips were soldered onto the motherboard. Adding extra memory up to the system's 16MB limit requires a memory expansion board. The 286L runs the system memory with one wait state.

The Maxar's floppy disk drive controller is built into the motherboard and can run two drives. The hard disk controller is a separate Western Digital unit, with an ST-506 interface and MFM encoding. The SE JIN Electronics 101-key keyboard has a loose, somewhat insubstantial feel and a minimal 72-inch cable.

Maxar 286L

The \$2,295 Maxar 286L's motherboard was silk-screened with the words HeadStart III and shares the HeadStart's unusual horizontal-tree expansion bus.





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MITSUBISHI ELECTRONICS
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Mitsubishi MP286

by Mitt Jones

The 130-watt power supply has four leads, representing the number needed for the possible three drives and one more to power the expansion slot board.

The expansion slots on this machine are somewhat unusual. The slots themselves are mounted on a board plugged into what looks like a normal 16-bit slot. The card has three slots on each side. You can put up to three full-length expansion cards on the left side and three half-length cards on the right. This space-saving design sounds good, but unlike the situation with the low-profile IBM PS/2s, where everything plugs in and out easily, you have to remove the expansion slot tree, as well as several different-sized screws and restraining bars, to add or remove cards.

After I took the expansion bus assembly apart to get a look at the video card, it took a good while and an extra pair of hands just to get most of it back together. I never could get one screw back correctly. This awkward design needs work.

There are reset and power switches on the front of the computer's case, along

My guess is that the engineers who designed the Mitsubishi MP286 chassis moved over from the construction industry. Perhaps they designed hurricane-proof buildings. Maybe they were the ones who built all those Wells-Fargo trucks. Whatever the case, you won't find a chassis built with more care—or more structural steel.

In fact, throughout the MP286, the design emphasis seems to have been placed on solid, dependable performance. This machine won't set any records for pricing or processor speed, but its overall quality and exceptional video make the 640K base system, at an expensive \$1,895, a pleasure to use.

Front-panel DIP switches are a trademark of Mitsubishi's desktops, and the MP286 is no exception. Hidden behind a small door on the front of the small-footprint chassis, which measures only 6 by 14.75 by 15 inches (HWD), two sets of switches let you specify settings such as bus and processor speed without dealing with the innards of your PC. The MP286 runs at 12 MHz with one wait state, 8 MHz with either zero or one, and 6 MHz with one. You can also set bus speed at either 6 or 8 MHz. Other switches let you enable and disable the machine's built-in ports—one serial and one parallel in our evaluation machine—and specify video type.

Also behind the small door, just above the DIP switches, the system reset button hides well out of accidental reach. In fact, the button is so far recessed into the plastic of the front panel that you have to push it with a pencil or similar object. For those of us who spend 10 percent of our lives looking for a pen, this degree of overkill can be downright irritating.

A power indicator, a hard disk indicator, and a system lock that locks both the cover and keyboard round out the front-panel attractions. Take a peek inside the machine and you'll find generously thick front and back planes, as well as a thick support that runs from the front plane to the back plane along the left edge of the drive carriage and power supply.

Four 16-bit slots and two 8-bit slots tie

on a small board that extends about halfway to the front of the machine. A Western Digital 2:1 interleave MFM controller capable of supporting two hard disks and a Video Seven 16-bit VGA board occupied two of the 16-bit slots of our evaluation. To the right, mostly hidden by the power supply and drive bays, lies the separate motherboard, made by Mitsubishi and based on its own VLSI chip set. A 80287 socket and the Intel-licensed AMD 12-MHz processor lie in plain view toward the left edge of the board. The MP286 uses Phoenix ROM BIOS Plus 3.10 10.

The Mitsubishi motherboard holds 640K of surface-mounted 120-nanosecond RAM, barely visible underneath the drive carriage. If you want to add more memory, you'll want to start with Mitsubishi.

Mitsubishi MP286

This \$4,493 configuration of the Mitsubishi MP286 features front-panel reset buttons and DIP switches, as well as unusually strong construction.



FACT FILE

Maxar 286L

Maxar PCs, 710 Lakeway, #285,
Sunnyvale, CA 94086, (800) 237-7703, (408)
733-0810.

List Price: With 1MB RAM, 1.2MB 5 1/4-inch
floppy disk drive, DOS 4.0, GW-BASIC, \$1,788;
with 40MB hard disk, VGA monitor, \$2,295.

In Short: The Maxar 286L is a low-profile 286
with many features built into the system board.
This machine is adequate for personal use but
not very expandable.

CIRCLE 407 ON READER SERVICE CARD

with power, turbo, and hard disk access lights. The user manual mentions a speed button on the front of the case, but there was no such button. In general the manual is helpful and reasonably clear. There are only occasional hints that it was not written by a native English writer: "It is indispensable for you to become acquainted with the connector locations on the back panel for attaching the various devices correctly."

The Maxar 286L is a good value in a small-sized 12-MHz AT clone, with some caveats. Adding memory requires buying an additional card, and adding cards in general is an unnecessary aggravation because of the awkward expansion bus design. The price for a configured system is reasonably competitive, and the performance is reasonable for a 12-MHz 286.

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categories for
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quality
construction."
(May 30, 1989)

PC
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performers in an
up-and-coming mid-
range firm.

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combination of value and
performance... from a vendor
with an increasing reputation
for quality. (Feb. 26, 1989),
18 MHz system.

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STANDARD CONFIGURATION

- Intel 80386-20 microprocessor
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- 64K of 4-way 256K/840 25ns static RAM cache
- Socket for Intel 80287 numeric coprocessor
- 1 32-bit, 16-bit and 8-bit slots
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- Available in standard monochrome (720x348, amber), standard VGA (640x480, color), or extended VGA (800x600 up to 1024x768, color)
- 1.44MB 3.5" diskette drive

Case Configuration	Standard	Standard	Standard
Configuration	Price	Price	Price
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299

DATA 386-25^A

STANDARD CONFIGURATION

- Intel 80386-25 microprocessor
- 1MB base memory RAM, expandable to 16MB or 32-MB memory
- 64K of 25ns static RAM cache
- Built-in PCMC slot and diagnostics with EGA/VGA resolution
- Socket for Intel 80287 or 80288 numeric coprocessor
- 1 32-bit, 8 16-bit and 1 8-bit slot
- Dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "Click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

AVAILABLE OPTIONS

- Full-size vertical case or mini-tower case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessors: 80287 or 80288
- 40MB to 300MB hard drive with MFM, RLL, ESDI or SCSI interface
- 40MB - 120MB tape backup drive
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color), or extended VGA (800x600 up to 1024x768, color)
- 1.44MB 3.5" diskette drive

Case Configuration	Standard	Standard	Standard
Configuration	Price	Price	Price
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299

DATA 386-16^W / -25^W

STANDARD CONFIGURATION

- Intel 80386-16, or -20, or -25 microprocessor
- 1MB base RAM, expandable to 16MB of 32-bit memory
- 25 MHz system features Intel 82385 cache controller with 32K 2-way set associative static cache
- LM EMS 4.0 drive supplied
- Socket for Intel 80387 numeric coprocessor
- 1 32-bit, 5 16-bit and 2 8-bit slots
- Dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

AVAILABLE OPTIONS

- Full-size vertical case or mini-tower case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessor: 80387
- 40MB to 300 MB hard drive with MFM, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drive
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color), or extended VGA (800x600 up to 1024x768, color)
- 1.44MB 3.5" diskette drive

Case Configuration	Standard	Standard	Standard
Configuration	Price	Price	Price
16-bit, 16MB, 80387, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80387, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80387, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80387, 3.5"	\$1,299	\$1,299	\$1,299

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STANDARD CONFIGURATION

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Case Configuration	Standard	Standard	Standard
Configuration	Price	Price	Price
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
16-bit, 16MB, 80287, 3.5"	\$1,299	\$1,299	\$1,299
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shi's Direct Memory Expansion daughter-card, which plugs into the motherboard to the left of the drive carriage and provides an additional 1 or 4 megabytes of 120-ns. RAM. Like the base 640K, the Direct Memory Expansion memory runs at 12 MHz. You can expand memory to 16MB with the addition of expansion slot memory boards, but that memory will run only at the 6- or 8-MHz bus speed.

The MP286 can accommodate four half-height drives: three 5¼-inch and one 3½-inch. The three 5¼-inch disk drives fit into the three stacked drive bays, the top two of which are accessible from the front panel. To the left of the drive bays and the Direct Memory Expansion connector, a bracket can hold a vertically mounted 3½-inch hard disk. Our evaluation unit came with a 1.2MB Mitsubishi floppy disk drive in the top bay and a 40MB 28-millisecond Mitsubishi hard disk in the bottom bay.

The 200-watt power supply, switchable between 115 and 230 volts, has only two leads, so you'll have to power additional drives via wye connectors. The Mitsubishi motherboard holds the Western Digital floppy disk controller circuitry and supports two floppy disk drives. Three small

nickel cadmium batteries, sealed in one container, attach to the bottom of the chassis with Velcro.

Key Tronic manufactures the Mitsubishi-labeled, Enhanced-style keyboard, but this is not the ultracheap, ultralight Key Tronic you'll find on many mail-order clones. Its weight and bulk are comforting, and overall it gives the impression of being solidly built.

Mitsubishi manufactures its own dis-

plays. Our evaluation unit came with a 14-inch VGA monitor.

The MP286 ships with DOS 3.3 and an excellent installation guide, both in Mitsubishi binders with holders. The installation guide details all aspects of getting the MP286 up and running, as well as adding various options. A generous number of explanations and illustrations do a nice job of explaining procedures to the novice. Software includes Multisoft's *PC-Kwik* disk caching software and Mitsubishi's setup and diagnostics disk.

Mitsubishi has a 1-year parts-and-labor warranty with carry-in service through TRW centers nationwide.

The overall feel of the machine is excellent. The chassis cover slides on and off smoothly; the keyboard is comfortable and substantial; and the Video Seven/Mitsubishi video combination runs smoothly, without jumping or popping when changing graphics modes. My only complaint concerns the Mitsubishi hard disk: one of the noisy variety, it's a bit more irritating than your average noisy disk.

Nit-picking aside, the Mitsubishi MP286 is a fine machine. With a \$4,493 list price for a 40MB VGA configuration,



FACT FILE

Mitsubishi MP286

Mitsubishi Electronics America Inc., Information Systems Div., 991 Knox St., Torrance, CA 90502; (213) 217-5732

List Price: With 640K RAM, 1.2MB 5¼-inch or 1.44MB 3½-inch floppy disk drive, DOS 3.3, GW-BASIC, \$1,895; with 1.6MB RAM, 40MB hard disk, VGA monitor, \$4,493.

In Short: A moderate performer in an impressively solid package, backed with a 1-year parts-and-labor warranty and carry-in service through TRW service centers.

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the MP286 doesn't come cheap, and its one-wait-state performance places it firmly in the middle of the 12-MHz pack. But if you're looking for a solid machine from a big-name company with carry-in service behind it, the MP286 deserves serious consideration.

MULTIMICRO INC.

MultiMicro 286/12

by Mitt Jones

The MultiMicro 286/12 epitomizes both the good and bad of the latest wave of too-good-to-be-true mail-order PCs. On the upside, you get a fast computer stuffed with name-brand components at a price that's truly hard to believe; on the downside, you can end up grappling for hours with parts that just don't fit right and documentation that belongs in the Ambiguity Hall of Fame.

The most intriguing aspect of the MultiMicro is its obvious value. \$1,480 buys you the basic configuration, complete with 1MB of 80-nanosecond memory, a 30MB Seagate hard disk, a 1.2MB 5¼-inch floppy disk drive, a 14-inch Samsung monochrome graphics monitor, two serial ports, one parallel port, a game port, and DOS 3.3. Our evaluation unit, bedecked with 4MB of RAM, a 40MB Toshiba hard disk, 1.2- and 1.44MB TEAC floppy disk drives, a Paradise 16-bit VGA controller, and a 14-inch Relisys multiscanning monitor, carried a list price of \$2,394.

When ordering, you can substitute components—Maxiswitch keyboard instead of Key Tronic, Video Seven VGA instead of Paradise, or Award BIOS in-

stead of Phoenix, for instance.

The MultiMicro offers additional value by virtue of its VIP Baby 286 motherboard, based on the Suntac chip set. The motherboard allows you to set not only processor speed—to either 6 MHz or 12 MHz, via the front-panel turbo switch—but also wait states. A jumper setting determines whether the machine runs with zero wait states or one. Our evaluation unit, endowed with 80-ns. DRAM, ran well at all settings.

Even more impressive, the Baby 286 allows you to emulate LIM 4.0 expanded memory using extended memory, a talent usually reserved for 386 machines. A chip by Autocomputer Co. Ltd. provides the necessary memory-handling capabilities, and a driver you include in your CONFIG.SYS file handles the emulation.

You'll also find ample options for adding memory on the motherboard. By using two sets of holes, slightly offset from one another, each socket can accommodate either the 16-pin 64-kilobit or 256-kilobit chips or the 18-pin 1-megabit chips. This arrangement lets you load the two 18-socket banks for a system total of anywhere from 256K to 4MB RAM. The system can accommodate up to 12 additional megabytes via standard memory-expansion cards.

A rechargeable nickel cadmium battery, 80287 coprocessor socket, and eight slots—two 8-bit and six 16-bit—round out the Baby 286's assets.

The MultiMicro's chassis, measuring 6.6 by 14 by 16 inches (HWD), also leaves plenty of room for growth, providing front-panel access for four half-height drives. Three half-height bays stack along the front right, and an additional 3½-inch disk drive can be installed on its side to the left. Fittingly, the 200-watt power supply has four leads, and the Western Digital controller—a WD 1006—supports two floppy disk drives and two hard disks.

The MultiMicro is not without its faults. First, our frequency counter showed that the bus runs at processor speed—either 6 or 12 MHz. While some machines run the bus at 12 and then dip to 6 or 8 MHz during I/O access, our evaluation unit dropped little in speed, if at all. The ability to drop to 6 MHz with the turbo switch should solve any expansion-card incompatibilities you may encounter, but you shouldn't have to run the processor at 6 MHz to retain I/O compatibility.

Next, the MultiMicro's chassis ranks among the more flimsy I've seen. For instance, with the unit cover off, I was able to flex the front and back panels with relatively little effort and even twist the entire unit. The FCC certification plate was conspicuously missing from our evaluation unit. A call to MultiMicro confirmed that FCC approval was still pending.

The documentation shipped with our machine was also problematic, primarily because it seemed written for a different machine. Worse, MultiMicro seemed unsure about which version of the motherboard was installed in the machine, both in the documentation and over the phone, making it difficult to determine the location of specific jumpers.

In all fairness, the documentation and

MultiMicro 286/12

The MultiMicro 286/12 costs only \$2,394 with 1MB of RAM, a 40MB hard disk, and a VGA monitor. It's a fast machine, but not sturdy in its construction.



PC FACT FILE



MultiMicro 286/12

MultiMicro Inc., 582 Folsom St., San Francisco, CA 94105; (415) 979-0140.

List Price: With 1MB RAM, 30MB hard disk, 1.2MB 5¼-inch floppy disk drive, monochrome monitor, DOS 3.3, \$1,480; with 40MB hard disk, VGA monitor, \$2,394; with 4MB RAM, 1.2MB 5¼-inch and 1.44MB 3½-inch floppy disk drive, \$3,450.

In Short: An ultra-low-cost mail-order machine that offers impressive features and performance. Problems include a flimsy chassis, inaccurate documentation, and a bus that runs at 12 MHz when the processor is run at that speed.

CIRCLE 408 ON READER SERVICE CARD

COMPUTERS

12-MHz 286 PCs

support problems may be due to the newness of this machine and to MultiMicro's inexperience in dealing with end users; the company reportedly has been building machines for other mail-order vendors but is only now beginning to sell directly to the public.

MultiMicro offers a 30-day money-back guarantee, 1-year warranty, and 1 year of free technical support with the machine. If a part fails, you'll have to mail it back to MultiMicro at your cost for up to 2 days of testing before the company will ship a new part.

Overall, the MultiMicro 286/12 performed remarkably well during testing; it comes at a price that's difficult to beat and offers an impressive array of features. Remember, however, that this machine is bargain-basement mail order all the way. Chances are you'll have problems, and they may take a bit of tinkering to solve. If that scares you, you're better off opting for a more-expensive system from a better-established mail-order house or local distributor.

NATIONAL MICROSYSTEMS INC.

Flash 286-12

by Bruce Brown

How clone can you go? National Microsystems makes no bones about its market intentions: the Flash 286-12 is a straight 12-MHz AT clone aimed at the mail-order buyer looking for standard components at a good price. And it hits the mark.

Starting with a rock-bottom \$699 512K unit with one 1.2MB 5¼-inch floppy disk drive, a drive controller, and a keyboard, National Microsystems builds computers and sells them at the lowest prices possible. The test machine had a full megabyte of memory, a small Seagate 20MB hard disk, an 8-bit Paradise VGA card, and a Samsung VGA monitor—all for a list price of \$1,749 including DOS 3.3 and GW-BASIC. A 40MB-drive system costs \$1,949. That's low.

The Flash 286-12 comes in a rugged case with thick structural components. The case itself measures 6.5 by 19.5 by 16.5 inches (HWD), which is full desktop size. There is room for five half-height storage devices, with three showing. The 200-watt power supply is big enough, but there are

only four power leads for storage devices; four drives are usually adequate anyway.

The test unit came with a Western Digital 1:1 interleave floppy/hard disk controller. This controller helped the computer score fairly well on hard disk tests, especially the small-record DOS File Access benchmark test. The controller uses an ST-506 interface and MFM encoding.

There are the usual six 16-bit slots and two 8-bit slots, five of which are free with a standard system that uses one slot for the drive controller, one for a parallel/serial I/O card, and one for a video card. One expansion slot of each kind can take only a half-length card.

The Maxi-Switch keyboard is OK, but not as precise-feeling as previous units I've tested by that brand. The key arrangement is the standard 101-key Enhanced design with 12 function keys across the top. The keyboard cable is 90 inches long.

You can use either 256-kilobit or 1-megabit chips in the motherboard. Depending on your choice, you can build the machine to a maximum of either 1MB or 4MB of RAM without an expansion card. Four megabytes is probably about the highest that most people who buy AT-type computers today need. If you want more, you can buy any 16-bit memory expansion card to build to the system maximum of 16MB. The system can be set for either zero- or one-wait-state operation via a motherboard jumper switch.

The Flash 286-12 uses an Atronic motherboard with G2 286 chip set components, an Intel 80286-12 processor, and AMI BIOS chips. System setup is conveniently located in ROM. The system switches between 8 and 12 MHz with either a keyboard sequence (Ctrl-Alt and Plus or Minus) or with a turbo button on the front of the unit right next to the power reset button, which is also convenient. In



FACT FILE

Flash 286-12

National Microsystems Inc., 2833 Peterson Pl., Norcross, GA 30071; (404) 446-0520

List Price: With 512K RAM, 1.2MB 5¼-inch floppy disk drive, \$699; with 1MB RAM, 40MB hard disk, VGA monitor, DOS 3.31, \$1,949; with 20MB hard disk, \$1,749.

In Short: There's nothing flashy about National Microsystems' Flash 286-12: a straight clone at a good price, with a 30-day money-back guarantee.

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Flash 286-12

The National MicroSystems Flash 286-12 gives you eight expansion slots, 1MB of RAM, a 40MB hard disk, and a VGA monitor for less than \$2,000.



either system clock setting, the expansion bus runs interface cards at a safe 8 MHz.

National MicroSystems sells the Flash 286-12 through mail order only. There is a 1-year parts-and-labor warranty with return shipping paid by the company, but no provision for on-site service. If you try the Flash 286-12 and don't like its performance or find that for any reason it's incompatible with your current needs, there's a no-questions-asked 30-day money-back guarantee.

The Flash 286-12 is a unit without surprises. National MicroSystems has put together a fine set of components at an extremely aggressive price. If you need a straight AT clone and want the best price possible, take a close look here.

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PREMIER COMPUTER
INNOVATIONS**Premier 1000 Plus**

by Bruce Brown

Little touches can make a big difference. For most computer vendors, the size and shape of the box that fits around the main system unit is determined by two factors: the dimensions of the unit's insides and the standard cases and covers available. The Premier 1000 Plus's case looks the same as you would find on most other full-size AT-class desktop computers until you get close: then you notice the diagonal stripes. The effect is a subtle dressing up; I didn't even notice the grooves until the second day I worked with the Premier.

Other than the case, there's nothing outstanding about the Premier 1000 Plus. List price for a no-hard-disk, no-monitor version is \$2,295, and the 40MB VGA system is a very high \$3,942. The Premier 1000 Plus's Western Digital motherboard, often paired with smaller cases, comes with an Intel 80286-12 processor, Faraday 286 chip set, and Phoenix ROM chips. Setup is in ROM. The system clock runs at either 6.25 or 12.5 MHz, and the expansion bus at 6 or 8 MHz.

Standard memory on the 1000 Plus is 1MB, expandable on the motherboard by replacing the stock 256-kilobit chips with 1-megabit chips, for a maximum of 4MB without buying an expansion board. The memory runs with one wait state and shadows RAM and video BIOS.

The standard 1.2MB 5¼-inch floppy disk drive is controlled by the motherboard-mounted, 1:1 interleave floppy/hard disk controller. That controller, including

a 32K disk cache for improved read/write times, can handle two floppy disk drives and two hard disks. The test system included a 40MB hard disk. Premier also sells 20-, 30-, and 80MB units, the last being the only other option that makes sense for this class of computer.

Other standard components include two serial ports, one parallel port, a PS/2-compatible mouse port, a 200-watt power supply with five power leads, and a 101-key Key Tronics keyboard with an 81-inch cable. This was an agreeably different Key Tronics model, with a pleasant, slightly concave design and a responsive though light touch.

The Premier comes with EGA circuitry also built into the Western Digital motherboard. We specified VGA systems for this review, so the test unit came with a 16-bit Paradise VGA adapter and a Magnavox VGA monitor.

Even though the full-size case measures 6.25 by 21.1 by 16.5 inches (HWD), there are only four expansion slots: three 16-bit and one 8-bit. Although the Premier can hold a full set of five half-height drives, which is great, using a motherboard with only four slots is inconceivable in such a large case. There's nothing wrong with a Western Digital motherboard; it's nice to have the drive bays, and it's true that lots of functions are built into the unit, but keep in mind that you will have only four slots for expansion.

You won't be disappointed by the Premier 1000 Plus's performance. It wasn't a chart burner, but the Premier scored in the midrange on all of our benchmark tests, helped by the hard disk cache and 16-bit video card.

Premier Computer Innovations, the vendor, is a division of Entertainment Marketing in Houston. The Premier 1000 Plus is not a mail-order machine: it is sold only through dealers, VARs and VADs (value-added resellers and value-added dealers)—both typically companies that specialize in vertical turnkey systems, and by a direct sales force going after the Fortune 1000. The bonus on the service side is an on-site service contract and parts-and-labor warranty that guarantees a 4-hour response time within 100 miles of 33 DASIS service centers and repair or replacement within 24 hours anywhere in the continental U.S. For an extra \$90, you can extend the contract and warranty to cover labor only for an additional year.

Premier 1000 Plus

The Premier 1000 Plus in our standard VGA configuration is an expensive \$3,942. The box is full-size but holds only four expansion slots.



Premier has targeted the corporate market for this box, which may account for the pinstripes on the case front. That must also explain the Premier 1000 Plus's premium price. Mail-order vendors often sell a similarly equipped Western Digital motherboard system including hard disk and EGA or VGA without charging much more than the price Premier wants for the basic system alone. Of course you need room in the list price to pay for sales commission and to negotiate with savvy customers, but little-known companies have a hard time selling at big-company prices in a market as competitive as 12-MHz 286 computers. The Premier 1000 Plus is a good-looking and fine-performing machine. Just add more slots and knock at least \$1,000 off the list price, please.

**FACT FILE****Premier 1000 Plus**

Premier Computer Innovations, 10310 Harwin Dr., Houston, TX 77036; (800) 347-1777, (713) 995-4433.

List Price: With 1MB RAM, 20MB hard disk, 1.2MB 5¼-inch floppy disk drive, \$2,295; with 40MB hard disk, VGA monitor, DOS 3.3, \$3,942. In Short: The Premier 1000 Plus is a big box with only four expansion card slots. An adequate performer with a high price but a terrific on-site service contract.

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- 5 Drive Bays - 3 Exposed, 2 Internal
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- Enhanced 101-Key Keyboard

Model 325

- Intel 80386-25 CPU running at 25/8 MHz
- Landmark v.1.1=41.8 MHz
- 1MB of 32-bit RAM expandable to 16MB
- Intel 82385 Cache Controller with 32KB Static RAM
- Shadow RAM Option for Video and BIOS included
- Intel 80387-25 and WEITEK 3167 Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interface
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-bit, five 16-bit, two 8-bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 320

- Intel 80386-20 CPU running at 20/8 MHz
- Landmark v.1.1=33.4 MHz
- 1MB of 32-bit RAM expandable to 16MB
- Intel 82385 Cache Controller with 32KB Static RAM
- Shadow RAM Option for Video and BIOS included
- Intel 80387-20 and WEITEK 3167 Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interface
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-bit, five 16-bit, two 8-bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 316

- Intel 80386-16 CPU running at 16/8 MHz
- Landmark v.1.1=26.1 MHz
- 1MB of 32-bit RAM expandable to 16MB
- Shadow RAM Option for Video and BIOS included
- Intel 80287-16 Math Co-Processor Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interface
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
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- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-bit, five 16-bit, two 8-bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
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Model 333

Hard Drive Capacity

Video Combs	60MB ESDI	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	\$4103	\$4649	\$4993	\$5449
14" EGA	\$4443	\$4989	\$5323	\$5779
14" VGA	\$4595	\$5131	\$5385	\$5931

Model 320

Hard Drive Capacity

Video Combs	60MB ESDI	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	\$2593	\$3049	\$3393	\$3849
14" EGA	\$2843	\$3389	\$3643	\$4189
14" VGA	\$2995	\$3531	\$3785	\$4331

Model 325

Hard Drive Capacity

Video Combs	60MB ESDI	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	\$3103	\$3649	\$3993	\$4449
14" EGA	\$3443	\$3989	\$4243	\$4789
14" VGA	\$3595	\$4131	\$4385	\$4931

Model 316

Hard Drive Capacity

Video Combs	60MB ESDI	90MB ESDI	150MB ESDI	330MB ESDI
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Performance Comparisons using PC Labs Benchmark Series Release 4:

	80286 Instruction W/s	Floating Point Calculation	Conventional Memory
ZEOS 286/12 Desktop	4.75	18.64	0.72
IBM PC AT (8MHz)	8.9%	35.60	1.32
IBM PS/2 Model 50	7.20	28.34	1.05

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Performance Comparisons using PC Labs Benchmark Series Release 4:

	80386 Instruction Mix	Floating Point Calculation	Conventional Memory
ZEOS 386/20 Desktop	2.67	10.40	0.39
IBM PS/2 Model 70-121	3.24	12.72	0.61
Compaq Deskpro 386/20e	2.91	10.54	0.40

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"For Overall Excellence..."

PC Magazine, May 30, 1989

"Out of 104 machines from 58 companies...for overall excellence in both the 16- and 20MHz categories, we selected ZEOS International's 386-16 and 386-20" PC Magazine, May 30, 1989

In the May 30th issue PC Magazine reviewed 104 machines from 58 manufacturers. Virtually every 386 in production was tested. The systems were grouped into three speed categories, 16, 20 and 25MHz. In two of the three categories *only one* company was selected for "overall excellence." That company is ZEOS.

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SUNRISE TECHNOLOGY INC.

Sunrise 286/12

by Mitt Jones

The Sunrise 286/12, designed by Sunrise Technology, looks a bit like something you'd expect to find in a Malibu surf shop, or maybe a beachside Miami watering hole. Its tropical blue and yellow accents come straight off a bottle of suntan lotion, and its low, rounded profile further adds to its ultracausal look.

Even if flip-flops aren't your style, however, don't write off the Sunrise 286/12 just yet. Besides ranking among the fastest 12-MHz machines around, this \$1,799 base-priced machine holds a surprise or two under its unusually small 3.25 by 15.50 by 15.25 inch (HWD) case.

Sunrise designed the 286/12 to snap and slide together, making use of screws only on the power supply and the expansion slot covers. The design also eliminates the ubiquitous ribbon and power cables by routing power through the motherboard. IBM probably deserves credit for pioneering the no-cables, no-tools-required approach to PC design with its PS/2s, but Sunrise has taken it one step further—and done a better job of it.

To remove the cover of the machine, you simply loosen two large, screw-like knobs on the back panel, unplug the power cord, and slide the cover back and up. Once inside, removing any given piece is simply a matter of figuring out which way to push or pull it. For instance, the removable drive carriage, which makes room for two half-height floppy disk drives in one side and a half-height hard disk in the other, attaches to the motherboard via a pinned connector and slides straight up and out. An industry-standard hard disk—in

our case a 28-millisecond, 30MB CDC—slides into place in the drive carriage itself, installing directly into an edge connector. To add a second floppy disk drive, you'll have to get a new faceplate from Sunrise to allow front-panel access.

Once you've gone through the process once or twice, you could probably dismantle the entire machine in about 2 minutes. I'm not sure you would want to, but Sunrise insists that the no-screws design is a boon for corporations that have their own PC maintenance and repair staffs.

The motherboard itself, which attaches to the bottom of the chassis with plastic pins and connects to the power supply via an edge connector, is unquestionably impressive. An array of VLSI components, including a 1:1 interleave Western Digital RLL disk controller and VLSI Technologies 286 chip set, furnish just about everything you need. Our evaluation unit, equipped with an AMD 12-MHz processor and an 80287 math coprocessor, came loaded with the motherboard maximum of 3MB of RAM: 1MB of 80-nanosecond DIPs and 2MB of 100-ns., 1MB snap-in SIMMs, totalling \$4,439. No monitor was included. Two serial ports and one parallel port are built into the motherboard.

About the only thing you won't find on the motherboard is a video adapter, but that comes standard in a proprietary snap-in module: Sunrise's roots are in the video controller/adaptor business. Surprisingly, the standard-equipment adapter is a slow 8-bit EGA. VGA, also 8-bit, is available as an option. The controllers themselves are 16-bit, but the adapter allows only 8-bit data transfer.

To add a little speed to its already fast zero-wait-state performance, the Sunrise shadows system and video BIOS in up to 128K RAM with the help of a utility that's included. Should you need to slow the system down a bit, another utility lets you control bus and processor speed at the hardware level. At processor speeds of 6 and 8 MHz, the bus runs at the same speed as the processor. At 12 MHz, the bus can be set to 6, 8, or 12 MHz. You can also toggle between two sets of speeds—6/6 and 12/8—using keyboard combinations. A front-panel turbo indicator lights up when the processor is running at 12 MHz.

Sunrise reports that its 286/12 will support LIM 4.0 emulation out of extended memory, but the software necessary to support the VLSI chip set's memory-map-

ping capabilities was not yet available at the time of this review.

The custom-made Sunrise keyboard is comfortably large and has a moderately clicky feel. The documentation, though not abundant, is sufficient and relatively straightforward.

My only serious problem with this machine concerns the front-panel indicators and controls of our early evaluation unit. Of the four indicators, only the access light on the standard-equipment 1.44MB 3½-inch floppy disk drive shone bright enough to be easily seen. The power, turbo, and hard disk indicators were only faintly visible in normal lighting. Worse still, the reset and power buttons, both blue, lacked labels. Especially in the light of the reset button's location immediately to the left of

Sunrise 286/12

The Sunrise 286/12 workstation features snap-together design for easy maintenance. With 1MB of RAM, a 30MB hard disk, and an EGA adapter, the system lists for \$2,639.



FACT FILE

Sunrise 286-12
 Sunrise Technology Inc., #11-11515 Horseshoe Way, Richmond, British Columbia, Canada V7A 4S5; (800) 663-8331, (604) 274-7406.
List Price: With 1MB RAM, 1.44MB 3½-inch floppy disk drive, \$1,799; with 30MB hard disk, VGA adapter, DOS 3.3, \$2,639; with 3MB RAM, 80287 coprocessor, \$4,439. 49MB hard disk, \$700.
In Short: A small, fast machine meticulously designed to allow no-tools maintenance and repairs.

CIRCLE 412 ON READER SERVICE CARD

COMPUTERS
12-MHz 286 PCs

the turbo indicator, this lack of labels could lead to disaster.

All things considered, the Sunrise 286/12 ranks near the top for overall quality and speed, as well as for thoughtful design. With only one 16-bit and two 8-bit slots, however, the machine may be too limited for consideration as anything but a network workstation—the application for which it was clearly designed.

TANDON CORP.

Tandon PCA-12

by Bruce Brown

Concerned about data security? Need to share computers with lots of people, many of whom have their own programs, separate data, and possibly even different operating systems? Want to carry your data with you? If any of these profiles fits you, consider Tandon's 286 computers with removable 30- or 40MB Data Pacs.

The Tandon 12-MHz 80286-based computer, called the PCA-12, lists for \$2,025 with 1MB RAM and a 1.2MB 5¼-

inch floppy disk drive. It does not include a hard disk, video adapter and monitor, or Data Pac. This base model has one serial and one parallel port. Standard software is DOS 3.3, Windows 2.1, and GW-BASIC.

Our standard configuration, a Tandon PCA-12 with a 40MB drive, 8-bit VGA adapter, and VGA monochrome monitor costs \$3,997, which is similar to machines from other second-tier brand names such as Wyse and Hewlett-Packard. The evaluation unit came with Tandon's removable Data Pac system, a combination of a \$699 In-Pac receptacle and a \$349 30MB Data Pac. This combination raises the price to a lofty \$5,245 but ensures flexible and secure removable data storage.

Tandon's Personal Data Pac system can be the only storage medium in a computer, a viable way to set up the system if many people who have their own personal information are to share the machine. The Data Pac receptacle takes up a full-height drive device space. When the Tandon starts up, the ROM checks out the system and, after determining which storage devices are present, lets you decide which disk will boot

up. This way you can run different operating systems easily on the PCA-12, assuming that you have each operating system loaded on a Data Pac.

Another interesting application of the Personal Data Pac system is for single users who have huge files. For example, engineers or designers with space-consuming CAD files might find removable Data Pacs a convenient way to store the files without needing incredibly large drives. Accountants who have lots of clients could



FACT FILE

Tandon PCA-12

Tandon Corp., 301 Science Dr., Moorpark, CA 93021; (805) 378-3000.

List Price: With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, DOS 3.3, GW-BASIC, \$2,025; with 40MB hard disk, VGA monitor, \$3,997; with 30MB Data Pac, \$5,245.

In Short: The Tandon PCA-12 is most interesting if you use it with Tandon's removable Personal Data Pac; otherwise it's just another 12-MHz 286 machine. The Data Pacs, while expensive and slow, are terrific for shared machines, data security, and transporting files.

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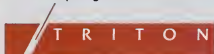
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also use Data Pacs efficiently.

Data Pacs are slower than normal hard disks but faster than CD-ROMs; the Conner hard disk used in the test system took about two-thirds the time the Data Pac took to find information in our large- and small-records DOS File Access tests. And unlike CD-ROMs, which are usually written to just once, Data Pacs can be written to and changed just like a normal drive. Since Data Pacs can boot computer systems, they go far beyond tape systems. However, the Data Pac is an expensive peripheral if you plan to use it only for backing up data.

Apart from the Data Pac system, the Tandon PCA-12 is a typical 80286 computer. Its performance on our benchmark tests was respectable for the class but not

outstanding. The system clock runs at either 8 or 12 MHz, but the expansion bus works at a constant 8 MHz. The full-sized case, 6.75 by 21 by 16.5 inches (HWD), has five half-height drive bays. This leaves just one half-height drive space in a system with a half-height 40MB hard disk, one half-height 1.2MB 5¼-inch floppy disk drive, and the full-height Data Pac. There are six 16-bit and two 8-bit expansion slots. The power supply is rated at 190 watts and has four power leads. The PCA-12's Hi-Tek 101-key keyboard was relatively unresponsive.

Tandon makes its own motherboard, 286 chip set, and BIOS. The memory chips are SIMMs; you can fit a total of 5MB on the motherboard without having to buy an extra card. Depending on the speed of the RAM chips the system can run at zero, .5, or one wait state. The Tandon uses page-mode memory interleaving but does not shadow the ROM or video BIOS in RAM.

The main reason to consider a Tandon PCA-12 is the Personal Data Pac system and the advantages it brings: removable, bootable, portable, secure media. Otherwise it's hard to justify the relatively high cost of this system.

Tandon PCA-12

The Tandon PCA-12 lists for \$3,997 in our standard configuration. Tandon's removable 30MB Data Pac raises the system cost to \$5,245.



can switch system speed either from the keyboard or via the front-mounted turbo switch, positioned next to a reset button. By changing motherboard jumpers you can select zero or one wait state.

The motherboard takes banks of either 256-kilobit or 1-megabit memory chips, so you can build the system to 4MB without buying an extra card. The MIT Systems 286-12 use page memory interleaving and shadows the ROM BIOS in RAM.

On the PC Labs benchmark tests this computer had top scores for the processor and conventional memory speed tests. The other scores were no better than average, reflecting the relatively slow VGA card and hard disk. Overall the MIT Systems 286-16's performance is very good.

The test unit came in a small-footprint

MIT Systems 286-12

Telemart's \$1,974 MIT Systems 286-12 comes in a small case that holds three drives, all of which can have exposed fronts for removable media.



TELEMART

MIT Systems 286-12

by Bruce Brown

Here's proof that it can be done right! The MIT Systems 286-12, sold by Telemart, is a winner on all four counts: price, performance, features, and service.

The base MIT Systems 286-12 with 512K RAM, one 1.2MB 5¼-inch floppy disk drive, and a keyboard sells for \$929. That price is fairly typical, but when you increase the memory to 1MB and then add a 40MB Seagate ST-251-1 hard disk with a Western Digital 1:1 interleave controller, a Paradise 8-bit VGA card and Imtec VGA monitor, an I/O card with two serial ports, one parallel port, and a game port, and DOS 4.01, the complete system costs only \$1,974. That's a great price.

The Intel 80286-12 processor in the MIT Systems 286-12 runs at either 12 or 6 MHz and the six 16-bit and two 8-bit expansion slots function at 8 or 6 MHz, depending on the current system speed. You





FACT FILE

MIT Systems 286-12

Telemart, 8604 North 23rd Ave., Phoenix, AZ 85021; (800) 428-6659, (602) 944-0402
List Price: With 512K RAM, 1.2MB 5¼-inch floppy disk drive, \$929; with 1MB RAM, 40MB hard disk, VGA monitor, DOS 4.01, \$1,974.
In Short: The MIT Systems 286-12's winning combination of price, performance, features, and service makes this mail-order done hard to overlook.

CIRCLE #14 ON READER SERVICE CARD

case, measuring 6.5 by 17.25 by 16.75 inches (HWD). This case holds only three storage devices, though the 200-watt power supply has four power leads. For the same price you can choose a larger case that has room for five drives.

The keyboard with this system is the only dull point in an otherwise bright picture. It's a disappointing Key Tronic unit with a dead feel and a minimally acceptable 72-inch cable. The keyboard has the standard 101-key Enhanced-style layout.

The MIT Systems 286-12 comes with the standard 1-year parts-and-labor warranty, but it also includes free on-site service from Sorbus if this becomes necessary. You can extend the on-site service contract for the incredibly low price of \$25 per year. The warranty and service contract cover everything as originally purchased; for that reason alone it pays to buy all the components from Telemart. To top off this generous service plan, there's a 30-day money-back guarantee.

Whichever way you look at it, the MIT Systems 286-12 comes out in front. There are other machines that match the performance, some that match the price, and many with the same features, but no one has the same service and support policies at such low prices. When you put it all together, Telemart's MIT Systems 286-12 is a sure winner.

TUSSEY COMPUTER PRODUCTS

Swan 286/12

by Bruce Brown

Slow but steady and sure describes Tussey Computer Products' Swan 286/12. This large Pennsylvania-based mail-order computer-systems-and-peripherals house sells microcomputers in many configurations.

COMPUTERS

12-MHz 286 PCs

The Swan 286/12, reviewed here, uses a conservative combination of components.

The basic Swan 286/12 costs \$999 with 512K RAM, one 1.2MB 5¼-inch floppy disk drive, game port, serial port, and parallel port. The test configuration with 1MB RAM, a 40MB hard disk, 8-bit VGA card,

Swan 286/12

Tussey Computer Products' Swan 286/12, tested at \$2,367, is a steady computer. Tussey uses the same case for different systems, as evidenced by the dummy turbo lights.



VGA color monitor, and DOS 3.31 costs a reasonable \$2,367.

The Swan 286/12 runs at either 12.5 or 6.25 MHz. At either speed the expansion bus stays at a very safe 6.25 MHz. The motherboard, manufactured by Twinhead International, uses the Chips and Technologies four-chip NEAT 286 chip set and Phoenix ROM BIOS. Memory wait states can be set to either one or zero.

The motherboard will hold a maximum of 1MB RAM, using 256-kilobit chips. If you want more memory, you must buy a memory expansion card. The system uses memory interleaving and shadow RAM, but its benchmark test scores span the gamut from a fast 80286 Instruction Mix to a ponderous Conventional Memory performance.

The full-size case is very sturdy and can hold up to five separate half-height drives, three of which can have exposed fronts for removable disks, tapes, or cartridges. The 200-watt power supply has five power leads.

Tussey supplies a Hi-Tek keyboard with this system. This keyboard has a good-length 100-inch cable and the standard Enhanced-style layout. Unfortunately, its feel is flat and unresponsive.

The test unit came with an Adaptec floppy/hard disk controller, with a standard ST-506 interface and MFM encoding. This controller supports up to two floppy and two hard disk drives.

Tussey has a good service and support mix, with a standard 1-year warranty on parts and labor and a 30-day no-questions-asked money-back guarantee. A third noteworthy component is Tussey's policy of toll-free technical support, available without charge—and without an expiration date. You can also use the toll-free number to inquire about billing and order information. If you have to ship a system to Tussey for service, the company uses the standard mirror-shipment practice.

In addition to the standard service and support, Tussey now offers two options: extended warranties and Sorbus on-site service contracts. These options are costly but can give corporate customers peace of mind. For instance, you would pay \$204.95 for a second-year Tussey war-



FACT FILE

Swan 286-12

Tussey Computer Products, 3075 Research Dr., State College, PA 16801; (800) 468-9044, (814) 234-2236

List Price: With 512K RAM, 1.2MB 5¼-inch floppy disk drive, \$999; with 1MB RAM, 40MB hard disk, VGA monitor, DOS 3.31, \$2,367.

In Short: Tussey's Swan 286-12 is a conservative but safe 12.5-MHz 286 clone. It's not a speed demon, but the price is right. Besides the 1-year warranty, Tussey gives a 30-day money-back guarantee and toll-free technical support.

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ALLOY

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COMPUTERS

12-MHz 286 PCs

ty with mail-in service, or \$689.95 for the Sorbus on-site service during the first 2 years of ownership.

In sum, the Swan 286/12 is a safe if unexciting choice in a mail-order AT clone. The performance lags a bit, reflecting an older, more conservative system design.

WYSE TECHNOLOGY

WYSEpc 286 Model 2112

by Bruce Brown

Wyse Technology makes computer terminals and systems. Some Wyse units have interesting technical details, while others tend to stay closer to the mainstream. The 12-MHz 286 unit that was tested for this review is one of the latter: a reassuringly unsurprising but only moderately performing machine.

The WYSEpc 286 Model 2112 is a workhorse 12-MHz 80286 with a base price of \$2,299 including 1MB of RAM, one 1.2MB 5¼-inch floppy disk drive, DOS 3.3, and GW-BASIC, but no hard disk and no video. The test configuration, with a 40MB Seagate hard disk, an 8-bit VGA adapter, and a Wyse VGA monitor, lists for \$4,067.

Standard features include one serial port, a parallel port, and a bouncy and responsive 101-key keyboard with an ample 108-inch cable. The Model 2112 case is a small-footprint design: 6.5 by 16.75 by 15 inches (HWD). There are five 16-bit expansion slots and two 8-bit slots, with four slots free in the test configuration. The case has room for three half-height drives, all of which can have exposed fronts for re-

PC FACT FILE

WYSEpc 286 Model 2112

Wyse Technology, 3471 N. First St., San Jose, CA 95134; (800) GET-WYSE.

List Price: With 1MB RAM, 1.2MB 5¼-inch floppy disk drive, DOS 3.3, GW-BASIC, \$2,299; with 40MB hard disk, VGA monitor, \$4,067.

In Short: The WYSEpc 286 Model 2112 is a conservative entry from a major vendor of terminals, systems, and peripherals. Distinguishing features include a small footprint, adequate expansion, and several nice design touches. The performance is a bit slow for the price, even among big-name companies.

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WYSEpc 286 Model 2112

The WYSEpc 286 Model 2112, with 1MB of RAM, a 40MB hard disk, and a VGA monitor, is expensive at \$4,067. A 16-character LCD shows the time, date, and system speed.



movable media.

This model is a fairly straightforward system, with a maximum of 1MB RAM on the motherboard. The dual-speed 8- or 12.5-MHz system clock runs memory with one wait state. The expansion bus runs at a constant 8 MHz.

Wyse makes its own motherboard and uses an Intel 80286-12 processor, the VLSI Technologies 286 chip set, and a Phoenix BIOS.

The standard Western Digital floppy/hard disk controller uses an ST-506 interface with MFM data encoding. The drive controller supports two floppy disk drives and two hard disks. With a 200-watt power supply, the Model 2112 is all set for a full load of memory, additional add-on cards, and a full complement of drives.



EDITOR'S CHOICE

• A 386SX Computer

Buy a 386SX.

80286 PCs account for 40 percent of the market, but the future lies with the 386. The new entry-level machine for business systems is a 386SX PC, and the best 286 computer you can buy is a 386SX. Compared with the 21 12-MHz 286 PCs reviewed in this issue, an SX system unit from the same vendor will cost \$250 to \$500 more, but all other costs are the same—monitor and video card, hard disk, software, training, and maintenance—and these costs are far more important than the initial purchase price.

PC Magazine will continue to cover the 286 market, but we won't award Editor's Choices because we can't recommend that you buy any of them. However, of the 21 machines reviewed here, several stand out.

If you do opt for a 12-MHz 286 PC, look first to Telemat's MIT Systems 286-12, which provides the best all-around support (30-day no-questions-asked return and 1-year on-site service included in its \$929 base-system price). It also turned in outstanding performance on the PC Labs Benchmark tests.

Three strong runners-up are the Everex Step 286-12, Destiny 286, and CompuAdd 286/12. Everex is

well known, well designed, and the fourth-fastest on our processor benchmark tests; in addition, its documentation is excellent. The \$2,299 system unit cost is reasonable when you consider the Everex reputation, the 1-year on-site service, and the discount you can expect from the dealer.

The S875 Destiny 286 had the fastest processor times of all, but its motherboard design means that the machine you buy may be different from what we tested (the two machines we reviewed had different motherboards).

CompuAdd's price (\$945), performance, and reputation are solid. Video performance on our test unit took five times as long as the Compaq, but you could substitute a faster video card. And should.

We also should mention the Austin 286/12.5 and the Northgate 286/12, the two best machines from our January 31, 1989, review of 13 other 286-12 PCs.

The Compaq Deskpro 286e? Great construction, superfast video, and the Compaq name don't compensate for the highest price and otherwise subpar performance. The same goes for Hewlett-Packard: good name, high price, slow performance.

The WYSEpc was in the bottom half on the PC Labs benchmark tests. The 40MB Seagate ST-251 hard disk, the only hard disk option Wyse offers with this computer, was noticeably slower than the drives in the other systems. Wyse uses none of the standard performance-enhancing schemes like memory interleaving, shadow RAM, or software disk caching.

Overall, the WYSEpc 286 Model 2112 gives one the impression of solid, tested technology—more like a four-door sedan with a six-cylinder engine and an automatic transmission than a sports car or a tiny econobox. One nice design detail is a 16-character LCD screen on the front of the system box, which displays either the time or the date as well as the current system speed. The screen also alerts you to system

error conditions that may exist.

Wyse computers are sold through dealers and value-added resellers. The standard warranty covers both parts and labor for 1 year. All service is performed at authorized Wyse service depots or by the third-party vendors, InterLogic Trace or TRW. On-site service and extended warranties are also available.

The WYSEpc 286 Model 2112 is somewhat slow, and its list price is conservatively high. It stands as a fair performer with good support, clearly designed with a corporate buyer in mind. ■

Bruce Brown is a frequent contributor to PC Magazine. Mitt Jones, currently a freelance writer living in New York City, was a senior editor of PC Magazine.

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give up your favorite
DOS applications
to network the
members of a small
office inexpensively.

DOS and the Multiuser Operating System

by Frank J. Derfler, Jr.

It's office-solutions time again, and here's the scenario. A group of people in an office need to be linked together by some form of network. Problem number 1: The budget allotted for achieving this task is small. Problem number 2: The group wants to run DOS applications. Solution: One of five relatively inexpensive multiuser operating systems for DOS applications that are currently on the market.

But we're getting ahead of the decision-making process. There are other alternatives, each a little less desirable in this case than installing *Concurrent DOS 386*, *PC-MOS Multiuser*, *Quick Connect/386*, *386/MultiWare*, or *VM/386 MultiUser*—the systems tested in this review that average about \$700 for less than ten users. Here are the reasons why.



PHOTOGRAPH BY MICHAEL GOODMAN

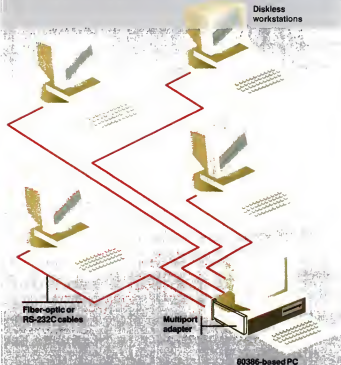


ECONOMICAL WORKGROUP COMPUTING

Only one CPU carries the load for the multiuser operating systems tested in this review, keeping costs down to a minimum. The workstations on each desktop are small, silent, and diskless. The type of video they provide is determined by the kind of connection they have to the central processor. RS-232C cables can support monochrome graphics, while fiber-optic

cables provide the bandwidth for CGA, EGA, and VGA video. The multiuser operating system resides in the 386-based machine and makes all of the resources of that machine available on a time-shared basis. The 386 host should be equipped with a large-capacity hard disk in addition to one or more floppy disk drives.

Diskless workstations



THE LAN ALTERNATIVE

You probably know the definition already. Workgroup computing means using computers connected together to exchange files and electronic mail, share printers and modems, access shared data files, and use workgroup scheduling and other productivity-enhancing programs. While there are several economical and effective ways to give a group of people these connected computing features, the most common alternative is to buy low-cost PCs and link

them together with a low-cost local area network (LAN).

If you shop carefully from the ads in computer publications, you can put together a network of five workstation PCs with 80286 processing power, monochrome graphics, a separate 80286 server, and network interfaces for as little as \$1,700 per node. Putting together this configuration with low-cost 80386 machines can cost as little as \$3,700 per node—including the server.

The LAN alternative to workgroup computing gives each person a dedicated desktop machine. This architecture of individual machines is nice from the perspective of performance and personal independence, but LANs can be tricky to install and maintain. Typical network problems include memory limitations, I/O address conflicts, and improper application software configurations. PC-based LANs also threaten the security of the data in your organization because people can download files to their own floppy disks and walk out the door with them. Finally, PCs can be big, hot, noisy pieces of furniture in a small office. By contrast, small and noiseless desktop terminals have a lot of appeal.

TIME-SHARING REVISITED

The oldest workgroup computing architecture, the one used in on-line mainframes, shares the time of a single processor among several users who communicate with the processor through display terminals. But this solution to the workgroup problem typically doesn't allow you to use popular DOS application programs except as tasks running under special control environments like VPIX under Unix. And while Unix, PIC, Theos, and VMS are multitasking, multiuser operating systems, you can't pick up a copy of *WordPerfect* or *Lotus 1-2-3* and run it on them.

But the oldest architecture is also the newest. New developments in processor and operating system technologies make it practical to share a single 80386 processor running DOS applications among four to six people who are equipped with inexpensive terminals. In many applications, this configuration makes it appear that each user has the power of a dedicated 80386 processor running standard DOS applications in 8086 mode. The five previously named multiuser operating systems currently on the market make this solution a reality.

TERMINAL MODE

The terminals used with these systems are small, quiet, and diskless. Their cost depends on the capabilities you need, but a pleasant-looking terminal with a good keyboard that displays only ASCII characters (no graphics) costs about \$400. If you must add serial ports to the host computer to communicate with the terminals, an RS-232C four-port board can cost several hundred dollars.

The cost for a multiuser 386-based sys-

DOS FOR MULTIUSERS

tem can be very low on a per-person basis. A shared 80386 machine requires 3 to 4MB of RAM and a large hard disk drive, so \$6,000 is a good estimate for the price of the computing hardware. The operating system will be under \$1,000 and each RS-232C monochrome terminal is about \$500, so a five-node system costs about \$1,900 per node. This configuration will run DOS applications with monochrome text and will yield excellent response times under typical use by four to six terminals.

Another development that makes running multiuser DOS applications even more practical is the entry of the SunRiver Fiber Optic Station into the market. Other terminals are limited to monochrome graphics because RS-232C and similar signaling schemes can't operate fast enough to present color graphics screens in a practical time period. The SunRiver terminals link to the shared processor over fiber-optic cables. These cables can handle the throughput needed to display EGA and even VGA applications.

The SunRiver scheme, however, isn't inexpensive. The VGA terminal itself costs \$2,199 plus a \$699 four-user fiber interface card, so the retail price for our typical multiuser system including LAN interface goes up to just over \$3,700 per node—the same price per node as you'd pay for monochrome 386-based PCs on a LAN. But even if you don't add the prorated cost of a server and software, this alternative is still less expensive than equipping each user with a dedicated 80386 machine, VGA monitor, and LAN interface—which would cost over \$5,000 per node. This shared-processor configuration also has significant data-management, data-security, and ergonomic benefits over a LAN.

WORKING WITH DOS

The multiuser operating systems reviewed here allow sharing of the CPU. They work in two different ways: *Quick Connect/386*, *386/MultiWare*, and *VM/386 MultiUser* are multiuser operating environments that work with standard DOS to give it multitasking capabilities. *Concurrent DOS 386* and *PC-MOS Multiuser* are complete operating systems that replace DOS. The DOS replacements emulate MS-DOS, and the companies that make them claim that they are compatible with any application program that uses standard DOS calls.

In the reviews that follow, you'll find in-depth evaluations of all five products. Except in cases where a product performs

exceptionally well or exceptionally poorly, however, the reviews do not mention a product's performance on a particular test. Instead, results are given in the benchmark test section.

In their present form, these multiuser operating systems and environments carry out the basic network functions of file exchange, printer sharing, and file sharing. But these systems don't have all of the bells and whistles accepted as standard in LANs. Only *Quick Connect/386* comes with its own electronic mail. The lack of NetBIOS services in these operating systems and environments means that many of the popular third-party mail packages won't run under the multiuser operating systems. Similarly, shared gateways to SNA and other computing environments are not available under some of these architectures.

SECURING THE SYSTEM

An important area of concern to many people is security. *PC-MOS Multiuser* has a good security system that has different levels of privileges. *386/MultiWare* and *Quick Connect/386* include a way to make subdirectories private, and *Concurrent DOS 386* has some password-level protection. But these three products don't give you the read/write/create security that is standard in the least-expensive LAN software. And under *VM/386 MultiUser*, any user can access all of the files that aren't open or protected in some way by an application program.

How many terminals can the system support? This is one of the oldest questions in computing, and the answer is always the same: It depends. You can support more compute-intensive tasks, like spreadsheets, on a single-host machine than you can disk-intensive tasks like database entry. So you might be comfortable with six, or even ten, terminals using spreadsheet programs at the same time, while four stations doing on-line data entry is probably the maximum load. And some very heavy processing tasks, like CAD, will not give good performance with a load of more than two or three stations.

The processing power allocated to any one task varies dynamically either with the task or with human management control. This means that you can mix different tasks, as well as power users and occasional users, very effectively.

These are young products. Expect a fast


series of new products and version releases with many added features. For certain vertical applications (such as CAD for architects or a small accounting network), for small offices where security of personal files isn't a factor, and for people who are concerned mainly with cost, a multiuser operating system running on an 80386 processor can be an excellent way to gain the advantages of workgroup computing while keeping familiar DOS applications.

Concurrent DOS 386

by M. Keith Thompson

Concurrent DOS 386, the multiuser and multitasking operating system for DOS applications from Digital Research, replaces and emulates PC/MS-DOS. *Concurrent DOS 386* comes in a few different configurations, including a \$395 version that allocates eight multitasking sessions among three users. Another version allocating 22 sessions among ten users costs \$495. The Multiuser Graphics Edition (MGE) for five users costs \$995 and allows full EGA graphics on the SunRiver Fiber Optic Stations. *Concurrent DOS* requires at least an AT-class machine.

The installation program is thorough as well as easy to use. Furthermore, it will co-reside with Microsoft DOS on the hard disk or format the entire disk for *Concurrent DOS*. The installation package creates the proper subdirectories and modifies the AUTOEXEC.BAT file. If you install the



FACT FILE

Concurrent DOS 386, Release 3.0
 Digital Research Inc.,
 70 Garden Ct.,
 Monterey, CA 93940;
 (800) 443-4200, (408)
 949-3898, (416) 360-
 5316 (in Canada).

List Price: Three users, \$395; ten users, \$495; five-user MGE system (available through VAPs), \$995.
Requires: 2MB RAM, 1.5MB disk space, 80386-based PC, one or more standard serial terminals, DOS 3.3. MGE requires SunRiver Fiber Optic Graphics Stations.

In Short: An inexpensive alternative to a LAN for a five-user system with a low cost per node, this product allows users to share files and printers with excellent freedom from individual system crashes. Probably not the best bet for graphics applications, but a good choice for groups doing such tasks as word processing and data entry.

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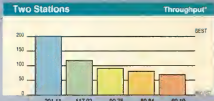
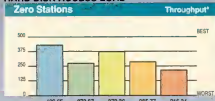




BENCHMARK TESTS: MULTIUSER OPERATING SYSTEMS FOR DOS APPLICATIONS

The performance of a 3- to 4-station 80386 multiuser system is on a par with DOS-based LANs such as IBM PC-NET, but not as fast as dedicated LAN operating systems like Novell's *NetWare*. However, each user gets performance equal to a 386 LAN workstation at a lower price, with greater security and less heat and noise. Our selection of Alloy Computer Products' *386/MultiWare* as Editor's Choice is borne out by its consistently strong test performance on an ASCII terminal.

HARD DISK ACCESS LOAD



The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. Each load station randomly accesses its own 100K data file using 1K records while the timed station transfers files. This procedure tests how well the software handles the drive and the speed of the disk subsystem.

* Kilobits per second.

The PC LAN Labs benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC in a typical heavy-use environment (such as a data-entry operation). We have designed these tests so that a single station represents five to ten times the load of a user performing an interactive task (such as updating records) on a typical network.

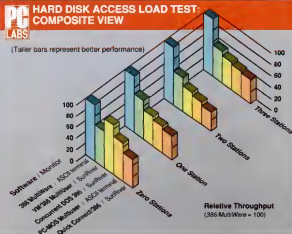
The **Hard Disk Access Load** and **Database Load** benchmark tests each report the throughput recorded during the performance of a standardized task on the network. To obtain the figures shown here, we run a test program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate among 16K, 4K, and 512 bytes. Usually a 1MB file is used, but this size may be adjusted for unusually fast or slow networks.

While the general test program is run, we load the network with specific programs for each of our two benchmark tests. The results shown represent the average throughput over a period of time sufficiently long to ensure consistency.



HARD DISK ACCESS LOAD TEST: COMPOSITE VIEW

(Taller bars represent better performance)





BENCHMARK TESTS: MULTIUSER OPERATING SYSTEMS FOR DOS APPLICATIONS

DATABASE LOAD

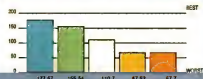
Zero Stations

Throughput*



Two Stations

Throughput*



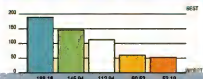
One Station

Throughput*



Three Stations

Throughput*



In the Database Load test, all stations share a 4MB data file and its index file during reading, locking, and writing tasks while the shared station transfers files. This test reflects the record-locking support of the system and the way it handles a number of random, simultaneous accesses to a common file.

* Kilobits per second.

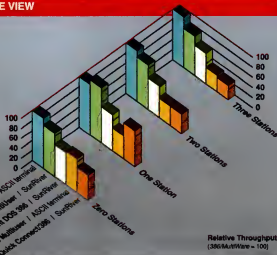


DATABASE LOAD TEST: COMPOSITE VIEW

(Taller bars represent better performance)

We ran our standard Hard Disk Access Load and Database Load tests for these evaluations, but not our Network Throughput Under Load test because there is no LAN media access to evaluate. A Compaq Deskpro 386/20 served as host for all tests.

The tests are not completely parallel because 386/MultiWare and PC-MOS Multiuser didn't have drivers ready for the SunRise workstations; their tests used multiport RS-232C boards and ASCII terminals. The throughput numbers derived from these tests primarily reflect processor efficiency and hard disk handling, but the different video systems can also affect throughput results.



Relative Throughput
(386MultiWare = 100)

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the executive suite, Dodds,
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When you think about it, it's only fitting that leaders of industry insist on the leader in magnetic media: Sony.

Ever since the introduction of the first tape recorder in Japan, Sony has been perfecting high-density magnetic media.

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Digital Research operating system co-resident with DOS, a boot-up utility program asks if you want to run *Concurrent* or just PC/MS-DOS.

The setup program allows the system manager to change the console and terminal profiles for each user. The console options allow you to allot memory for a RAMdisk, set LIM emulation specifications, and enable Ctrl-Alt-Del. The terminal options range from type of keyboard to type of devices installed in local ports.

EXTRA FEATURES

Concurrent DOS has some features you don't usually find in MS-DOS. The operating system has a built-in help facility (similar to AT&T's version of DOS 3.2) available at the OS prompt by typing HELP or HELP COPY. For the security minded, *Concurrent DOS* has a password-protection scheme to limit access to files and directories. Also included are a few helpful programs: File Manager is similar to some DOS shells allowing menu-driven DOS commands. DR.EDIX is a useful text editor that is far superior to EDLIN. CARDFILE, a standard part of the operating system package, keeps track of names and addresses. There is also a limited function-menu program.

When a product like *Concurrent DOS* tries to emulate a product like Microsoft DOS, there are some incompatibilities. When we tried to run *Microsoft Windows 2.03*, the program got confused and started beeping and spitting out strange characters. To *Concurrent's* credit, *Windows* did finally exit, without crashing the system. DOS users who are adept at using function keys like F1 and F3 will have to learn to do things a little differently under *Concurrent DOS* because these repeat-key functions are not available.

LAN versions of various applications ran without a glitch. If you are unable to obtain a LAN version of your application or are writing software yourself, DRI has some helpful hints on how to make the software run properly.

The multitasking ability of *Concurrent DOS* allows a user to run multiple programs on one terminal. Users switch between sessions by holding down the Ctrl key while hitting the session number on the numeric keypad (1, 2, 3, or 4). *Concurrent DOS* virtualizes the screens on each text program, thus allowing background programs or ill-behaved programs to execute without writing directly to the screen of the foreground application. So if you're using

your word processor and you have *Symphony* in the background, when *Symphony* updates the clock on the screen, there is no change on your word processing screen. *Concurrent DOS* also allows the user to create windows for well-behaved programs to manage the multitasking better.

The software allows a certain amount of flexibility; you can redirect the local ports to any other port on the system. You manage print jobs in the queue with a screen showing the built-in print spooler, as well as adjust the order of jobs in the queue and send jobs to any of three parallel or nine serial printers.

Concurrent DOS also permits multiple users to connect to a Novell *NetWare* network. The 386 computer with the network card acts as a gateway for the terminals. People using the terminals can access the network file server, but because of the 128K environment limitation, the network is limited to basic file transfer only.

The MGE version of *Concurrent DOS*, designed for the SunRiver Fiber Optic Stations, works just as well as a single-user system with an EGA monitor. The fiber-optic connections allow for fast transmission speed, and the screen quality is superb. In real-world applications, a 20-MHz 386 can service three EGA programs without an unacceptable speed loss.

Concurrent DOS comes with four manuals: Installation, Reference, User, and Running Applications. The Installation and Reference manuals are complete, but the User Guide covers only how to use the operating system. Missing is the information necessary to use the system quickly and efficiently. The Running Applications manual gives some information about installing some applications, but it falls short of helping you get them up and running quickly. While we can't praise the documentation, we can praise the as-yet-unannounced technical support we received over the phone.

Concurrent DOS is a good product for general-purpose multiuser applications. Our testing showed the possibility of compatibility problems with highly graphical programs. If you're considering a connection to a larger network, a different selection—such as Alloy Computer Products' *386/MultiWare*—might be better. But *Concurrent DOS's* virtual-session architecture prevents one user from crashing the system, which makes it completely trustworthy for small workgroup applications.

PC-MOS Multiuser

by M. Keith Thompson

PC-MOS Multiuser has been in the market longer than its competitors, so it's no surprise that it sports more features—such as strong security, SNA gateways capabilities, and integration with Novell's *NetWare*—than do its competitors. On the down side, *PC-MOS Multiuser* is difficult to install and maintain. While it is best known in its single-user release, a version able to support five users is available for \$595, and one for 25 users costs \$995.

Like *Concurrent DOS*, *PC-MOS Multiuser* is a complete operating system that replaces and emulates Microsoft DOS. Unlike *Concurrent DOS*, *PC-MOS* allows multiuser operation on 80286 and even 8088-based computers. Because of memory and performance limitations with less-powerful systems, we recommend using *PC-MOS* with 80386 host machines in multiuser applications.

Various companies that market multiport RS-232C adapter cards include drivers for *PC-MOS*. We used both a DigiBoard marketed by DigiBoard Inc. and a Maxspeed marketed by The Software Link. The software needed to integrate the multiport adapters with the operating system came on floppy disks boxed with each card.

Similarly, The Software Link includes drivers in *PC-MOS* for a wide variety of terminals. Almost any standard ASCII terminal can be accommodated, but you will probably want to use a terminal with a PC-type screen and keyboard available from



FACT FILE

PC-MOS Multiuser, Version 3.0
The Software Link,
3577 Parkway Ln.,
Norcross, GA 30092;
(800) 451-LINK, (404) 448-5465.
List Price: Five users, \$595; 25 users, \$995.
Requires: 1MB RAM, 1MB disk space, 80286- or 80386-based PC, one or more standard serial terminals, DOS 2.0 or later.
In Short: PC-MOS Multiuser is a robust operating system that offers many features—such as security, mainframe connections, and NetWare integration—but requires considerable expertise to install and support.



CIRCLE 544 ON READER SERVICE CARD

DOS FOR MULTIUSERS

Link, Wyse, and other companies. During our evaluation, The Software Link was on the verge of releasing drivers for the SunRiver Fiber Optic Stations. This integration will let people using SunRiver terminals run standard DOS applications in EGA and even VGA mode.

Each terminal establishes a separate session with *PC-MOS* running on the 80386. Each session can load TSR programs and can run programs requiring both EMS 3.2 memory and a math coprocessor.

A big plus for *PC-MOS* is the true independence of the terminal sessions. The operation and performance of each session is practically unaffected by what the others

A plus for *PC-MOS* is the independence of the terminal sessions. The performance of each session is almost unaffected by what the others are doing, except during multiple requests for service from a shared device.

are doing. The exception, of course, occurs when multiple requests for service from some shared device like the hard disk are queued.

However, this plus is also a limitation. Since *PC-MOS* doesn't dynamically allocate memory or CPU time slices as do other products in this roundup, the maximum performance any single user will see is also limited by the configuration that is fixed at start-up.

Five other pluses for the operating system are the integration of a print job spool, NetBIOS emulation, security, SNA connections, and *NetWare* integration. The print job spooler lacks the management features found on spoolers included in typical LAN software, but it will meet most requirements.

The NetBIOS emulation in *PC-MOS* is strong enough to run all well-behaved NetBIOS applications. This means that multiuser database, electronic mail, spreadsheets, and many other network applications can run on *PC-MOS*.

The security system in *PC-MOS* equals that found in many LANs and older non-DOS multiuser operating systems. You can give to a resource any of 27 security levels and limit the functions of any individual to execute only, read and execute, and no access.

There are two ways to communicate with IBM SNA mainframe computer systems in a *PC-MOS* system. The Software Link has integrated the DCA IRMA cards and the Sangoma ClusterComm SNA gateway product into *PC-MOS*. The IRMA card gives one mainframe session that can be used by one *PC-MOS* terminal at a time. The Sangoma ClusterComm is a true SNA gateway that distributes up to 16 mainframe sessions to the *PC-MOS* terminals.

NETWORK LINK

Another significant feature of *PC-MOS* is its integration with Novell's *NetWare*; Novell wrote the drivers for The Software Link's product. Up to 16 *PC-MOS* nodes can operate as satellite stations on a Novell *NetWare* LAN. In our tests, this interface appeared simple and trouble-free.

PC-MOS is not an A:INSTALL type of software package. In fact, you need to have achieved "DOS guru" standing before even attempting to install the multitasking multiuser version of this operating system. There are many detailed installation options, the documentation needs work, and we experienced much more frustration trying to get this system operational than we did with any of the others tested.

All factors concerning the setup and operation of *PC-MOS* are handled through a series of CONFIG.SYS and .BAT files. This seems like a simple concept and some other successful packages use it, but not with the amount of arcane detail required by *PC-MOS*.

There are many parameters and files that have to be called in the right place with the right configuration in order to get the system operational. One example of the degree of detail involved: some of the software switches that you use to call operational program files require uppercase let-

ters and others use lowercase letters. The operating system does a good job of pointing out syntax errors, but this salve does little to ease the pain.

This is one of the few PC-based products that we recommend should be installed by a dealer or by someone with a lot of DOS experience who has been to The Software Link school.

PC-MOS gives uneven performance. When running on terminals operating over RS-232C lines at 19,200 bits per second, you'll notice a lag time between keyboard input and screen response. Because of an excellent disk-caching system, certain types of file actions are very fast. The cache system can be configured to accept and hold write requests, although this involves some risk in the event of system failure. But the operating system seems to take several times longer to create a file than does Microsoft DOS.

Because there are so many variables, a knowledgeable installer or system administrator can fine-tune *PC-MOS* to give a specific session very fast response, perhaps at some cost to other sessions. During our benchmark tests, we gave each *PC/MOS* 386 station the same number of processor "slices," but this specification can be adjusted to meet workgroup application requirements.

"Don't try this at home, kids, leave it to the professionals" should be the motto of *PC-MOS* in the multiuser mode. If you have a dealer who will install this operating system and you send one of your people to school, or if The Software Link comes out with a good menu-driven installation and control program, *PC-MOS* is a good choice for its reliability, performance, and number of features.

Quick Connect/386

by Mike Byrd

Quick Connect/386 (QC/386) operates with MS-DOS 3.x to furnish a multiuser operating environment on an 80386-based PC. The five-user version costs \$595; 16 users, \$995. ASCII, ANSI, and PC terminals, as well as color-graphics workstations, can be attached to the host PC to create multiple workstations on a single PC. All users can share data files, application programs, peripherals (such as printers, plotters, and modems) and the processing power of the host machine.

Each *Quick Connect/386* user logs onto

CONNECTIVITY DOS FOR MULTIUSERS


FACT FILE

Quick Connect 386
Virtual Systems Inc.
1990 N. California Blvd.,
#903, Walnut Creek,
CA 94596. (415) 935-4944

List Price: Five users, \$595; 16 users, \$995
Requires: 1MB RAM, 500K disk space, 80386-based PC, one or more standard serial terminals, DOS 3.0 or later

In Short: A simplified LAN capability without LAN cost or complexity, Quick Connect 386 offers a multiple-workstation system on a single PC allowing users to share files, applications, and peripherals. Slow for applications such as data entry, but suitable for word processing and CAD/desktop publishing.

CIRCLE 545 ON READER SERVICE CARD



a virtual 8086 machine. All users share the same DOS and obtain memory for their partition space from any unallocated RAM. The host PC acts as a nondedicated file server, so the keyboard and screen directly attached to the host also serve as a workstation. QC/386 supports the DOS Share facility, which controls the file and record locking for multiuser application programs.

QC/386 supports multiple accounts (users, groups, and/or applications). A simple menu-driven utility assigns and maintains user accounts, logical device assignments, file tables, and default parameters. At log-in, password verification, memory allocation, and optional start-up command execution occur in sequence. When a user logs out, memory and other resources are released for use by others.

SECURE RESOURCES

The user account name and associated password provide system security. Each user can log on at any station, but can access only his own account's assigned resources and file areas. For example, a user name could be an application such as WORDSTAR. Each WORDSTAR user could access only the WORDSTAR program and assigned file areas. The QC/386 system would keep the the WORDSTAR user(s) out of other unassigned resources.

QC/386 also has electronic mail, modem communications, and compatibility with common DOS applications. The package supports multiple printers connected to the host PC or a workstation.

The QC/386 print spooling system consists of two programs: a Print Spool Man-

ager and a Print Queue Manager. The spool manager is a TSR program that runs in each user's partition and redirects the data to a spool file. The queue manager runs in a separate partition and sends spooled print files to the selected printer. The spooling system supplied for the review was in beta form and should be available at publication time.

When application memory requirements exceed the user's memory partition size, QC/386 activates LIM/EMS support. QC/386 also offers a virtual disk option using extended memory as storage for the virtual drive. Multiple users can share the 80x87 math coprocessor, if one is installed.

The minimum hardware requirements are a 386 computer, 1MB RAM, DOS 3.x, and one or more terminals attached to serial ports. Rather than using network interface cards, QC/386 supports various multidisplay adapters such as the SunRiver

QC/386 was slow on benchmark tests, but with two stations under heavy networking load, the third station performed a heavy number-crunching test like an 8-MHz AT.

and multiport serial adapters for ASCII/ANSI terminals.

QC/386 comes with 5 1/4- or 3 1/2-inch floppy disks in a three-ring binder that contains the Installation Guide, User Guide, Technical Reference, and Quick Reference. Installation is a two-part process involving software installation and configuration setup. The four-page software installation procedure took longer to read than to perform.

The setup utility takes much longer and requires an intimate knowledge of your adapter card, your peripherals, and all interfaces. Between the documentation and

the menu-driven setup program, the configuration setup is straightforward—it just takes time.

QC/386 is marketed through distributors and dealers; the dealers are trained to provide technical support. Virtual Systems also has a technical hotline service.

The networking benchmark tests showed QC/386 to be relatively slow compared with the other systems, but when we used applications on the network we didn't perceive any difference. With two stations under heavy networking load, the third station performed a heavy number-crunching benchmark test (without a math coprocessor) yielding the performance of an 8-MHz AT. The display graphics were good, but there were occasional hesitations when there were conflicting requests for service. The performance of alternate input devices such as mice and digitizers is acceptable.

The e-mail system is menu driven and works quite well. The system alerts a user that he has mail when returning to DOS from an application. If you are at a DOS prompt when someone sends you mail, you will not see this message until you run another program and return to DOS. If mail is waiting when you log on, there will be no indication unless you run the EMAIL program or enter the CMAIL command (which could be put into your log-on .BAT file). The menu-driven e-mail utility allows message creation as well as file transfer (binary or ASCII).

Virtual Systems touts Quick Connect/386's ability to support major graphics applications like AutoCAD and Ventura Publisher, and for good reason. With fast workstations like the SunRiver, QC/386 is well suited for a five-user CAD/graphics system.

386/MultiWare

by M. Keith Thompson

Alloy Computer Products' 386/MultiWare is a fast multiuser, multitasking operating system environment that works with Microsoft DOS. Alloy rewrote its original resource-sharing software, NTNX, to use the features of the 80386. A five-user version of the package costs \$395, and an unlimited user version sells for \$995.

386/MultiWare supports up to 20 terminals through Alloy's Intelligent MultiPort cards (IMP). Alloy offers a two- and an eight-port version of the IMP. These cards have on-board memory and a communica-

CONNECTIVITY

DOS FOR MULTIUSERS

tions processor that makes it easier for the 80386 to run programs while the IMP handles communications to the terminals. A variety of terminals called "PCTerm" are supported, including ones with multiple I/O ports and Hercules graphics. The price of the IMPs are \$495 and \$1,995 respectively.

In order to buy the proper IMP, system managers not only need to determine the

386/MultiWare is compatible with most multiuser, multitasking software written for Novell's *NerWare*, IBM's *PC Local Area Network Program*, and IBM's DOS 3.1 file-locking calls. We successfully tested a variety of network and multiuser applications. Alloy includes some helpful hints for making nonnetworkable and custom software perform correctly.

System managers will like the built-in security features of 386/MultiWare. Users are assigned privilege levels (1 through 4). Level 1 is for the supervisor, and level 4 is for the lowest user capabilities. This scheme allows the manager to restrict how many tasks a user can run.

386/MultiWare also includes a utility that manages security at the directory level. You can limit access to a directory so that only a specific group of people can see it. A person may belong to up to eight such access groups. This security scheme allows users to share some restricted directories while maintaining some private ones. This security scheme isn't as elaborate as those found in LAN software today, but it is probably adequate for most installations.

VIRTUAL ISOLATION

One of the best features of 386/MultiWare is its ability to run in the virtual 8086 mode of the 80386. This mode allows each terminal and each terminal's session to be completely isolated from any other. For example, if someone walks up to the console and hits Ctrl-Alt-Del, only the session in the foreground on the console is rebooted. This also holds true for a terminal that has a program crash; that terminal can be restarted without interrupting other users.

Alloy's 386/MultiWare performed well on our throughput tests. Some of its speed comes from the "smart" RS-232C multi-port card that relieves the processor of many I/O handling chores. But the Alloy product also benefits from an excellent disk-caching system. The throughput of the timed test actually increases as the Database Load Test increases. These tests were repeated several times with consistent results. We have seen this pattern of increasing throughput before in LANs using Novell's *NerWare* and attribute it to disk-caching algorithms optimized for a specific load.

Alloy did leave out a few features some users would have appreciated. Users on the terminals do not get to take advantage of the math coprocessor or use extra mem-

ory for LIM emulation if it is present in the host. NetBIOS support for electronic mail and gateway systems is also absent.

Alloy's print spooler supports four parallel printers and as many serial printers as there are available COM ports. Additionally, you can print to a local printer attached to the auxiliary port available on many terminals. Each user can redirect his output to any port on the system. The spooler then queues the output and sends it to the proper device along with a separator page describing where the job originated.

386/MultiWare is an excellent product and top contender in the young 386 multiuser operating system market. Alloy starts with the Microsoft DOS OEM kit to maintain maximum compatibility, then rewrites the file-handling routines to increase speed in a multiuser environment.

VM/386 MultiUser

by Mike Byrd

IGC's *VM/386*—winner of the 1988 PC Magazine Technical Excellence Award for 386 Software Technology—has a new sibling, *VM/386 MultiUser*.

VM/386 MultiUser—at \$895 for an unlimited user package—can do everything its relative can do, plus multiprocessing. The program designates one multitasking 386 PC as the central processor for a group of text and/or graphics workstations. Main memory, hard disk space, programs, data, and peripherals are all shared among several users. All DOS applications are fully supported at each station. With multiuser

386 MultiWare, Version 1.0
Alloy Computer Products, 100 Pennsylvania Ave., Framingham, MA 01701; (800) 544-7551, (508) 875-6100.
List Price: Five users, \$395; unlimited user version, \$995.
Intelligent I/O controller card for two users, \$495; for eight users, \$1,995.
Requires: 2MB RAM, 2MB disk space, 80386-based PC, one or more PCTerm terminals, DOS 3.3.
In Short: A fast multiuser, multitasking operating system that works with MS-DOS. Its compatibility and reliability rate high. The system performs best when the number of heavy users is limited to eight.

CIRCLE 346 ON READER SERVICE CARD

number of users, but which tasks each user will undertake. The two-port cards support text only, and the eight-port cards support up to four graphics and four text terminals.

The installation program is informative and quick: the user tells the program where to install the software, and the rest is automatic. The program displays the directory structure and the types of files it creates. A possible improvement on the installation program might be an ability to modify the AUTOEXEC.BAT file to give a choice of running 386/MultiWare or DOS.

CUSTOMIZED TERMINALS

Alloy allows complete customization of the terminals by giving each user unique CONFIG.SYS and AUTOEXEC.BAT files. In addition, each terminal can run up to eight different programs at the same time. You could, for example, use word-processing software, enter accounting data, and work on a spreadsheet at the same time. 386/MultiWare virtualizes the screens of each program, allowing ill-behaved programs to operate in the background without writing directly to the foreground screen.

VM/386 MultiUser, Version 1.21
IGC, 4800 Great America Pkwy., Santa Clara, CA 95054-1221, (800) 458-9108, (408) 986-8373.
List Price: Unlimited user package, \$895.
Requires: 2MB RAM plus 1MB additional per user, 1.2MB disk space, 80386-based PC, one or more PC-compatible terminals, DOS 3.0 or later.
In Short: A true multitasker multiprocessor-compatible DOS program offering the advantages of multiprocessing without the complexity of a LAN. Easy to install and relatively bulletproof afterward. A system especially built for the multiuser requiring simultaneous access to a common database.

CIRCLE 347 ON READER SERVICE CARD

DOS FOR MULTIUSERS

software, several users can even work on the same file at once, gaining true multi-user capability without the adapter cards and complexity of a network, but also without the security that network software provides.

VM/386 MultiUser utilizes the virtual 8086 mode of the 80386 to create a series of virtual machines. Each virtual machine runs concurrently and behaves like a separate IBM PC. The original VM/386 allowed the host 386 PC to multitask existing DOS applications through the host machine. **VM/386 MultiUser** retains that capability in addition to creating a PC for each workstation.

Each user of the VM/386 *MultiUser* system has his own copy of DOS, AUTOEXEC, and CONFIG files and can have TSR (terminate-and-stay-resident) programs. Users can have up to 640K RAM plus optional extended or EMS memory (LIM 4.0). If a user crashes an application, he can reboot his node without affecting the other active nodes or the host. Hitting Ctrl-Alt-Del on one machine doesn't affect the others.

VM/386 MultiUser sits on top of DOS; it loads by issuing a DOS line command.

There are no drivers in the host CONFIG.SYS file. Any drivers required for an application are loaded in the files called CONFIG.VMX or AUTOEXEC.VMX for the applicable virtual machine.

With VM/386 MultiUser,
users can reboot
after crashing without
affecting other
stations or the host.

There are no restrictions on accessing host resources. The only restriction enforced is that a file opened by one virtual machine is not accessible to another virtual machine unless the application has opened the file as shared. Sign-on passwords for each station are the only security.

SIMULTANEOUS ACCESS

If the host has a network adapter card installed, any one virtual machine may connect to the network with full network services available. With the addition of *VM/386 NetPak* (an optional IGC product) all virtual machines have full simultaneous access to the network.

A printer connected to the host 386 PC can be spooled for multiple access by several users or assigned exclusively to one user. A printer may also connect directly to a terminal for access only by that terminal. *VM/386 MultiUser* gives complete, transparent access to all system resources under the control of a system administrator at the host 386 PC.

A unique feature of VMI/386 MultiUser is the System Resource Manager (SRM). The SRM reallocates slices of processing time depending on demands put upon the system. For example, any virtual machines that aren't active and generating hardware interrupts are put to sleep. Thus a single active user has nearly the full power of the host machine. In actual use, since CPU resources are assigned on a need basis, response varies with user load.

We saw some instances on compute-

M O R E D A T A B A S E L E S S M O N E Y

ABCDEFGHIJKLMNOPQRSTUVWXYZ

PC-File:dB

REPORT CARD

James Burton

Overall Rating

Business Impact

Value for Money

Customer Support

Ease of Use

A

B+

A-

A

FEATURES

- Maximum # records YES
- Business grouping YES
- Read/write dBASE directly YES
- LAN network support YES
- Filed duplicate records YES
- Use backup records YES
- Suspicious mailing labels YES
- Drop to DOS YES
- Merge fields YES
- Integrated word processor YES
- Mail merge YES
- Relational database YES

PC-File:dB

dBASE

PFS:FileMaker

1 Buttons

No Multitask

SLIP

YES

NO

NO

YES

NO

NO

YES

NO

NO

YES

NO

NO

YES

NO

YES

YES

YES

NO

YES

YES

YES

YES

YES

YES

YES

YES

YES

List price

\$99

\$149

\$209

Back to dBASEics

Round here we think its fundamental. Reading and writing dBASE files that is. After all, PC-File:dB isn't a replacement for dBASE.

An improvement for non-programmers, yes. More intuitive, definitely. But not a replacement. With our context sensitive help screens and very human interface,

you'll never get the two confused.

"Why buy another copy of dBASE when you can pick up PC-File:dB for under \$100," asks PC Magazine." We have other advantages too (see chart), not the least of which is our price. For more basics, visit your dealer today or call 1-800-JBUTTON (in WA state, 206-454-0479).

- "SRO PC-File: dB Reads, Writer, dBase Files," PC Magazine, April 25, 1989, pg. 58

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CIRCLE 494 ON READER SERVICE CARD

ButtonWare

PC-File:dB is a trademark of ButtonWare, Inc.

DOS FOR MULTIUSERS

intensive tests (no hardware interrupts) where the stations and/or tasks seemed to go to sleep. This situation can be resolved by bypassing the SRM with the system administrator, but to the detriment of overall system performance.

VM/386, a leading performer in *PC Magazine's* most recent roundup of multitasking environments, "When One PC Equals Four: 386 Multitasking Environments" (February 28, 1989), didn't place as well among its peers in the multiuser market. However, it is optimized more for

3MB RAM. Additional terminals and virtual machines for multitasking on the host require more memory. A base system running *VM/386 MultiUser* and one virtual machine on the host, two workstations, and a spooled printer, requires just under 3MB. It also needs a hard disk and at least one floppy disk drive.

VM/386 MultiUser supports up to eight text terminals by using the standard COM1 and COM2 ports combined with one or more RS-232C multipoint boards. Each COM port on the host system or multipoint board supports a terminal. *VM/386 MultiUser* also supports the SunRiver Fiber Optic Station connected to an EGA fiber-optics board and the Viewport Technology EGA controller cards. You can mix text terminals and EGA graphics terminals, connected to their respective ports and boards, in one *VM/386 MultiUser* system.

VM/386 MultiUser comes in both 5¼-inch and 3½-inch disks with a spiral-bound manual. The package can run from two to eight stations and is unlimited by the software license agreement. Installation is relatively easy. A menu-driven program integrates the system for the equipment being used and then configures itself accordingly. A setup program on the distribution disk transfers the files to the hard disk and installs the drivers for the video monitor and hard disk. This procedure gets the system up and running on the host machine.

Additional work is required to get the workstations on-line. Two additional files must be edited to define the correct drivers for the multipoint card and terminals as well as the port and terminal assignments. Additionally, the terminals and multipoint adapter board(s) must be configured correctly to work with the software.

Luckily, the installation manual goes into painfully detailed (but necessary) instructions to accomplish the workstation installation. Explicit instructions for many multipoint boards, the SunRiver Light Adapter, and associated terminals are included in the manual. This portion of the installation isn't difficult, it's just time-consuming and requires a little luck. Fortunately, if any glitches develop, there is free technical support, via an 800 number, available for the first 120 days.

When you first load *VM/386 MultiUser* at the host machine, you are booted into the system administrator. The system administrator can add or terminate nodes, alter priorities of jobs in the print queue, and

prioritize system access time (time-slice allocation).

All tasks are pop-up menu driven and self-explanatory. If you require multitasking on the host machine, pressing the Alt-Sys RQ keys will switch to another virtual machine.

VM/386 MultiUser is completely DOS based and DOS compatible. It lets you install your existing DOS files and applications in a low-cost multiuser system without the complexity of networking. However, there are almost no LAN fea-



EDITOR'S CHOICE

• 386/MultiWare, Version 1.0

You can safely select any of the multiuser operating systems from this pool of five on the basis of features that best suit your needs; there's not a bad one in the bunch. Yet we feel that design features like DOS compatibility, the strength of the virtual sessions, and the flexibility of the time-slicing management are important enough to set one package apart from the rest. On this basis, the best overall system is Alloy Computer Products' *386/MultiWare*, Version 1.0. *386/MultiWare* strictly isolates each session, offers good management flexibility, and is easy to install and use.

Two products deserve mention for their special-purpose capabilities. If you foresee a time when you'll want to link the shared 80386 processor and its terminals to a LAN, then *PC-MOS Multiuser* should be your first choice. The Software Link's product has excellent interfaces with Novell's *NetWare*. If you intend to run graphics applications like *AutoCAD* and *Ventura Publisher*, Virtual Systems' *Quick Connect/386* handles these applications with exceptional ease.

processor-intensive tasks, such as CAD programs, than for the disk- and processor-intensive tasks performed in our multiuser benchmark tests.

VM/386 MultiUser runs on 80386 computers, such as the Compaq Deskpro 386 and the IBM PS/2 Model 80, as well as 286-based computers upgraded with an Intel Inboard 386/AT. It does not run on XT's with a 386 card. *VM/386* requires at least

VM/386 MultiUser

lets you install your existing DOS files and applications in a low-cost multiuser system without the complexity of networking, but it includes almost no LAN features, such as security or e-mail.

tures (security, e-mail, accounting) included. While the speed of computing and file access is quite adequate, you are sharing the power of the 386. As you add users, you divide that power. But for small offices that will stay small or for small offices that might later expand to a full LAN, *VM/386 MultiUser* is certainly a good choice for effective and economical workgroup computing. ■

Mike Byrd holds master's degrees in engineering from Purdue and computer science from Southern Methodist University. A fighter pilot for the U.S. Air Force, he is also a division chief in a branch of the federal government that develops sophisticated electronic systems. Frank J. Dierfler, Jr., is workgroup systems editor of PC Magazine. M. Keith Thompson invented the AT TurboSwitch and founded Megahertz Corp. He has worked as a developer and consultant since the first Altair.

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BJ-130
Bubble-Jet Printer

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CIRCLE 155 ON READER SERVICE CARD

by
Ray Duncan

Utilities

In a DOS system, CONFIG.SYS is usually a simple file that gets loaded at boot-up and consists of FILES= and BUFFERS= statements and perhaps a couple of DEVICE= statements needed by special add-ons. With this perspective in mind, you will probably be in for a shock when you take your first look at an OS/2 CONFIG.SYS file.

In contrast to DOS, which supports about 10 distinct configuration directives (depending on the version), OS/2, Version 1.1, supports 26 different directives and uses CONFIG.SYS files that often run to 50 lines or more. My own typical OS/2 CONFIG.SYS file is shown in Figure 1.

To guide you through the maze of setup options, our second PC Magazine OS/2 utility—CONFIG.EXE—provides a specialized, full-screen editor specifically designed to create and modify OS/2 CONFIG.SYS files. The best way to get your copy of the utility is to download it (or its source code, CONFIG.C) directly from PC MagNet; the process is explained in the "CONFIG by Modem" sidebar. As an alternative, you can compile the CONFIG.C listing printed with this article, but the result will be a simplified version of CONFIG.EXE that lacks both the full on-line help for each directive and the syntax-checking features that are built into the downloadable version. Moral: If you haven't gotten a modem yet, you're behind the times.

You can compile either version of the source code with the Microsoft C Compiler, Version 5.1 or later, simply by entering the command

CL CONFIG.C

No special switches or module definition (.DEF) files are needed. Make sure, however, that the reference library OS2.LIB or DOSCALLS.LIB is available in one of the directories named in your LIB= environment variable.

Unfortunately, because the program was written in a high-level language, it's

**CONFIGURING OS/2
FOR YOUR SYSTEM:
Our CONFIG.EXE
utility simplifies the
complex job of setting
the options in your
OS/2 CONFIG.SYS file.**

not feasible to provide a listing of BASIC DATA statements from which it could be created.

OS/2 CONFIGURATION DIRECTIVES

Before getting into the details of how CONFIG.EXE is used and how it works, I'll try to bring some order out of the OS/2 configuration chaos by providing a brief overview of the most important or unfamiliar directives. Like their DOS counterparts, OS/2 configuration file directives generally have two parts: a name and a value. In most cases, the two are separated by an equals sign (=). For example, in the directive

DEVICE=C:\COM2.SYS

the name is DEVICE and the value is C:\COM2.SYS. The name specifies the action to be carried out by the kernel, or core, of the OS/2 operating system. In this case, the name tells OS/2 to load a device driver. The value modifies the action—in this case, it specifies the file C:\COM2.SYS, the optional asynchronous communications driver for PS/2 machines.

A CONFIG.SYS directive may be as long as 256 characters, although lines longer than 80 characters are uncommon. IBM "recommends" that you use only

uppercase in your CONFIG.SYS file, though in my experience both upper- and lowercase directives seem to work. The official admonition stems from the fact that some IBM-designed device drivers, when scanning the DEVICE= line, can't recognize optional switches that are specified in lower case. (The so-called programmers of such stupidly written device drivers should, of course, be tarred, feathered, and run out of town on a Micro Channel bus rather than be allowed to restrict the contents of our CONFIG.SYS files, but what can you do?)

For this discussion, I've arbitrarily divided the valid OS/2 configuration directives into the five groups shown in Figure 2. The figure lists both the possible and default values for each name, whether the directive is allowed to occur multiple times within the CONFIG.SYS file, and whether it affects the behavior of OS/2 in protected mode, real mode, or both.

SHELL AND ENVIRONMENT DIRECTIVES

The Shell and Environment group is concerned, directly or indirectly, with launching programs. SHELL= and PROTSHELL= specify the names and locations of the command-line interpreters for real- and protected-mode sessions, respectively. SET allows you to define or modify environment variables for all protected-mode sessions during the system boot process. The environment of each session can be further customized with SET commands entered at the prompt or through a batch file. RUN= lets you start up a background process, such as a spooler or an e-mail program. The BREAK= and FCBS= directives act only on the real-mode session and have the same behavior as in DOS.

The LIBPATH= directive is particularly important. It tells the system loader where to find dynamic link (dynamlink) libraries, which are one of OS/2's most elegant and important features. The routines in dynamlink libraries are bound to an application program at its load time, as opposed

Utilities

to being incorporated as a permanent part of the application's .EXE file. (The latter is the more traditional sense of linking.)

Dynamic linking conserves RAM because the same physical copy of the routines can be shared among all of the applications that use them. Dynamic linking also conserves disk space, since the size of each application's .EXE file is reduced. Program maintenance is also simplified,

because the routines in a dynlink library can be modified at any time, and the applications that use the library will automatically benefit from the modifications the next time they are run. Note that the function of LIBPATH= is totally independent of the more familiar PATH= environment variable that is used by the shell or command processor to search for application programs.

MULTITASKING DIRECTIVES

The four directives in the multitasking category address another of OS/2's key capa-

bilities: its preemptive, priority-driven multitasking. These directives allow to fine-tune OS/2's scheduler—the kernel module that decides how much CPU to give to each task and when to give it to meet the needs of special software or hardware.

The THREADS directive controls maximum number of distinct points of execution (threads) the system can accommodate at any given time. This must not be confused with the number of program processes that can be running simultaneously. Each process may, and often does, contain multiple threads that share access to the process's memory, files, and so on.

If an executing thread doesn't voluntarily give up control by finishing its task, TIMESLICE specifies the minimum maximum times that can be allotted before the CPU's attention is preempted and given to another thread by the scheduler. Although the parameters for this directive are specified in milliseconds, the actual values used by the scheduler are always multiples of the system's timer interval (31 ms. in IBM's OS/2, Vers 1.0 and 1.1).

The PRIORITY directive controls whether the OS/2 scheduler is allowed to adjust the priorities of threads dynamically. For example, if PRIORITY=1 (NAMED), OS/2 always gives an extra boost to the priority of the thread currently forming keyboard input. Shifting CPU resources to favor the application that is being used improves the overall performance of the system.

The MAXWAIT directive specifies the maximum amount of time a thread can "starve" for CPU cycles. If a thread doesn't get a chance to run for MAXWAIT seconds because other, higher priority threads are hogging the CPU, the thread's priority will temporarily be pushed upward so that it can make progress. Needless to say, if PRIORITY=ABSOLUTE, the MAXWAIT directive has no effect.

PROTECTION AND MANAGING MEMORY

The directives in the Protection and Memory Management group influence yet another of OS/2's principal features: protected-mode operation. Two of them are related to OS/2's notorious Achilles' heel: the DOS compatibility environment, a.k.a. the 3.x box.

One of the advantages of protected-mode operation is that tasks can be com-

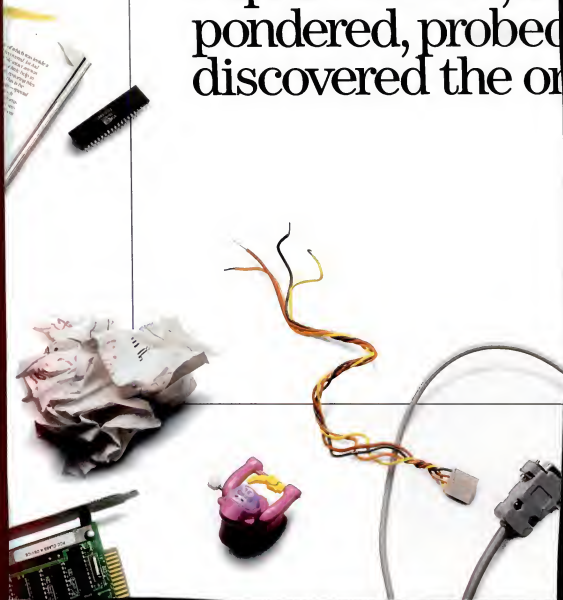
TYPICAL CONFIG.SYS FILE

COMPLETE LISTING

```
PROTSHELL=C:\OS2\PMShell.EXE C:\OS2\OS2.INI C:\OS2\CMD.EXE
SHELL=C:\OS2\COMMAND.COM /P /E:1024
SET PATH=C:\OS2;C:\OS2\SYSTEM;C:\;d:\forth;os2;c:\pmsdk\pbin
;c:\pmsdk\bin;c:\tools;p;c:\briefp
SET DPATH=C:\OS2;C:\OS2\SYSTEM;C:\OS2\INSTALL;C:\;
LIBPATH=C:\OS2\DLL;c:\briefp\dll
SWAPPATH=C:\TEMP 512
SET PROMPT=$p$ _PM$g
THREADS=128
MAXWAIT=3
MEMMAN=SWAP.MOVE
PROTECTONLY=NO
RMSIZE=640
IOPL=YES
BREAK=OFF
BUFFERS=20
DISKCACHE=512
FCBS=16,8
COUNTRY=001,C:\OS2\SYSTEM\COUNTRY.SYS
DEVINFO=SCR,VGA,C:\OS2\VIOTBL.DCP
DEVICE=C:\OS2\POINTDD.SYS
DEVICE=C:\OS2\MOUSEB02.SYS MODEL=199
DEVICE=C:\OS2\COM02.SYS
DEVICE=C:\OS2\PMDD.SYS
DEVICE=C:\OS2\EGA.SYS
SET COMSPEC=C:\OS2\CMD.EXE
SET include=c:\pmsdk\include
SET init=c:\init
SET lib=c:\pmsdk\lib
SET qh=c:\pmsdk\pbin +50
SET temp=c:\temp
SET tmp=c:\temp
SET url=d:\forth\os2
SET user=c:\init
REM BRIEF editor initialization
SET bpath=c:\briefp\macros
SET bhelp=c:\briefp\help
SET bbackup=.
SET bcc="cd -c %s.c"
SET bcasm="masm %s\;"
SET bpackages=c,asm:r;txt,doc;wp
SET bflags=-ai120L50u100zM96 -mRGD -mrestore
SET bfile=c:\briefp\state.rst
```

Figure 1: A CONFIG.SYS file often consists of 50 lines or more under IBM's OS/2, Version 1.1, which supports 26 different directives. Above are some typical CONFIG.SYS file entries as used by the author on his PS/2 Model 80 system.

You've analyzed, s
experimented, in
pondered, probed
discovered the on



SCANNER

Pretty pictures, aren't they? Actually, the black and white images, right down to the brush strokes on Mona Lisa's hands, come unretouched from the HP ScanJet Plus scanner. It's the first affordable 8-bit scanner to bring photographic quality to your desktop.

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bound and loose-leaf doc-

uments as well as it scans

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and experience the finest

desktop reproduction avail-

able. A woman like Lisa

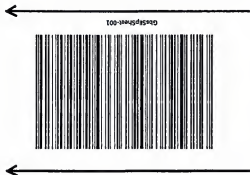
deserves no less.



Looks are



Folded edge of the page



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

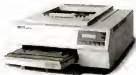
Back

0018-back500



Inverted Back

1. Follow instructions on the other side

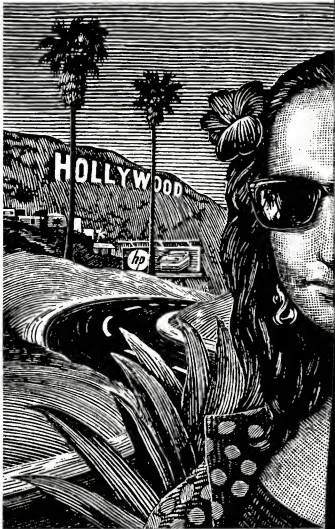


You already know about the HP LaserJet printer's razor-sharp text, saturated black tones and large selection of scalable typefaces. They've made LaserJet the most popular laser printer in history.

But we felt our equally fine graphics capability went unappreciated. So we commissioned this portrait of an old friend who moved to L.A. Notice her smooth curves, subtle gray shades and highly defined features.

There's a LaserJet to meet everyone's needs. Whether you need larger paper volume, duplexing or envelope feeding. So when it really counts, better do it on a LaserJet. The original, and still the best.

L A S E R J E T



You've spent
the best years
of your life
searching for it.

scrutinized,
investigated, dissected,
and finally
the eternal truth.



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Why settle for dot matrix when you can have laser quality? The HP DeskJet PLUS printer prints at 300 DPI, thanks to its advanced inkjet technology.

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DeskJet PLUS works with the most popular software and with any IBM-compatible PC. So take a look at DeskJet PLUS. It may not be a laser printer but you don't have to tell.

D E S K J E T



*Suggested U.S. list price.

P A I N T J E T

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Send us your most creative computer output,* along with this entry form. Soon, you could be sporting a mysterious smile of your own.

Please print your name and address on the output printout as well as completing this entry form.

Attached, please find my entry in Hewlett-Packard's "Looks are Everything" Sweepstakes.

Please answer the following questions:

1. Is working with PCs fun for you, almost a hobby?

Yes ☐ No ☐

2. Do you spend time helping co-workers solve computer-related problems?

Yes ☐ No ☐

3. Do people within and outside your company ask your opinion about what

NAME _____

COMPANY & TITLE _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____ DAYTIME PHONE _____

TO CREATE MY MASTERPIECE, I USED (SOFTWARE, COMPUTER, PERIPHERAL, FONTS) _____

COMMENTS _____

*In lieu of enclosing computer output, you may send completed sweepstakes entry form only (name, address, and phone # required)

See official rules below for details

types of PC hardware/software to buy?

Yes ☐ No ☐

4. Do you personally buy equipment for yourself and/or others?

Yes ☐ No ☐

5. Please briefly answer the following questions:

WHAT IS POSTSCRIPT? _____

WHAT IS OCR? _____

WHAT IS MICRO CHANNEL? _____

WHAT IS A BATCH FILE? _____

WHAT IS EXTENDED MEMORY? _____

Hewlett-Packard "Looks are Everything" Sweepstakes

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3. Prizes. **First Prize:** One Hewlett-Packard system, which will include one of each of the following: Vectra Q8/20 PC, LaserJet Series II printer, PaintJet color printer, DeskJet PLUS printer, ScanJet Plus scanner, Graphics Gallery

Collection Software package which includes Drawing Gallery and Charting Gallery (approx. total retail value \$14,364).

8 Second Prizes: One of the following Hewlett-Packard peripheral products per winner as determined by chance: (2) LaserJet Series II printers (approx. retail value per item \$2,695), (2) ScanJet Plus scanners (approx. retail value per item \$2,190), (2) PaintJet color printers (approx. retail value per item \$1,395), (2) DeskJet PLUS printers (approx. retail value per item \$995).

50 Third Prizes: One Hewlett-Packard Graphics Gallery Collection software package which includes Drawing Gallery and Charting Gallery (approx. retail value per item \$499) per winner.

200 Fourth Prizes: One Hewlett-Packard ProCollection Font Cartridge (approx. retail value per item \$300) per winner.

4. Drawing. Winners will be selected from among all entries in a random drawing to be conducted on or about December 1, 1989 by the Howard Mariboro Group, an independent agency. Winners will be notified by mail 6-8 weeks after drawing. Odds of winning will depend upon the number of entries received. All decisions will be final.

5. General. All taxes on prizes are responsibility of winners. Prizes won by minors will be

awarded in the name of parent or legal guardian. Affidavits of eligibility and publicity/liability releases will be required of major prize winners, and failure to return them within time specified will cause prize award to be void. No prize transfers. No prize substitutions except by sponsor due to prize unavailability. Only one winner per family or household. By participating, entrants agree a) to these rules and decisions of the independent agency which shall be final in all respects; b) to the use of their names, addresses, entries—including any attachments—in advertising and promotional materials for Hewlett-Packard products. If prize is returned undeliverable, it will be awarded to an alternate winner. All local, state and federal laws apply.

6. Winners List. For names of prize winners, send a self-addressed stamped envelope after 1989 to: Hewlett-Packard Sweepstakes Winners, P.O. Box 8015-345, Redondo Beach, CA 90277.



**HEWLETT
PACKARD**

Utilities

pletely isolated from the hardware, from one another, and from the operating system proper. Thus, if a task attempts to read from or write to I/O ports directly, or to disable interrupts, or to access memory

that does not belong to it, a *fault* (an internal interrupt) is generated. When this happens, the operating system takes control and the errant program is terminated. The IOPL directive allows you to ease this harsh regimen somewhat, so that programs that access the hardware directly (such as graphics programs that do not work through the Presentation Manager)

will still be allowed to run.

Another advantage of protected-mode operation is the ability to support *virtual memory*, which allows programs to allocate more memory than physically exists in the system. To do this, those segments that are not currently being referenced are written to disk (*swapped out*) until they are needed. The SWAPPATH directive al-



OS/2 CONFIG.SYS DIRECTIVES

Directive name	Possible values	Default value	Occurs multiple times	Affects OS/2 in protected mode	Affects OS/2 in real mode
SHELL AND ENVIRONMENT					
BREAK	ON or OFF	OFF	○	○	●
FCBS	maximum, protected	16, 8	○	○	●
LIBPATH	path[path...]	Root directory, boot drive	○	●	○
PROTSHELL	shellname, cmdprocessname	PMSHELL.EXE, CMD.EXE	○	○	○
RUN	pathname	Not applicable	○	●	○
SET	environmentname=value	Not applicable	●	●	○
SHELL	pathname	COMMAND.COM	○	○	●
MULTITASKING					
MAXWAIT	1-255 (seconds)	3 seconds	○	●	●
PRIORITY	ABSOLUTE or DYNAMIC	DYNAMIC	○	●	●
THREADS	16-256 (seconds)	64	○	○	○
TIMESLICE	minimum, maximum (ms.)	32, 248 (ms.)	○	●	●
PROTECTION AND MEMORY MANAGEMENT					
IOPL	YES or NO	NO	○	●	○
IOPL	pathname[pathname...]	Not applicable	●	●	○
MEMMAN	SWAP or NOSWAP, MOVE or NOMOVE	SWAP, MOVE	○	●	○
PROTECTONLY	YES or NO	NO	○	●	●
RMSIZE	0-640 (kilobytes)	Top of conventional memory	○	●	●
SWAPPATH	drive:[path]	Root directory, boot drive	○	●	○
INTERNATIONALIZATION SUPPORT					
CODEPAGE	primary[,secondary]	OEM-dependent	○	●	●
COUNTRY	countrycode	001 (U.S.)	○	●	●
DEVINFO	devicetype, subtype, pathname	Not applicable	●	●	●
MISCELLANEOUS					
BUFFERS	4-99	Hardware-dependent	○	●	●
DEVICE	pathname	Not applicable	●	●	●
DISKCACHE	64-6,900 (kilobytes)	No caching	○	○	●
PAUSEONERROR	YES or NO	YES	○	●	●
REM	any text	Not applicable	●	●	●
TRACE	ON or OFF [event[,event...]]	OFF	●	●	●
TRACEBUF	1-63 (kilobytes)	4K (if TRACE ON)	○	●	●

●—Yes ○—No

Figure 2: The table above shows the directive names and values (possible and default) that can go into OS/2 CONFIG.SYS files. The multiple-occurrence column indicates whether a directive may appear more than once within a CONFIG.SYS file. The protected-mode and real-mode columns indicate whether these directives affect the operation of OS/2 and its applications in protected mode, real mode, or both. The DOS FILES= or LASTDRIVE= directive may be present in an OS/2 CONFIG.SYS file, but it is ignored.

Utilities

lows the user to provide a disk and a path for storing the SWAPFILE. The system default for the SWAPPATH is the root directory of the boot drive. Segments can also be moved around so that several small chunks of free RAM can be united into larger blocks. This segment moving and swapping is invisible to application programs and is performed by two operating-system modules, the *virtual memory manager* and the *swapper*.

Unfortunately, segment moving and swapping do take significant amounts of time, which can seriously compromise the performance of device drivers and applications that must service high-speed real-time devices. Thus, the MEMMAN directive is provided to allow you to disable segment swapping and/or motion for such situations.

Finally, PROTECTONLY= and RMSIZE= control the operation of the DOS compatibility session. More specifically, if PROTECTONLY=YES, the DOS compatibility session is completely disabled and real-mode (that is, DOS) application programs cannot be run under OS/2 at all. If PROTECTONLY=NO, the session is enabled and the RMSIZE= directive specifies how much memory of the memory below 640K will be allocated



Figure 4: This screen display shows CONFIG.EXE in its browse mode. You should note that the currently active line is highlighted.

for the use of RMSIZE=.

The IOPL and PROTECTONLY directives are critical for system security. If a Trojan horse or virus program is introduced into an OS/2 system, it will probably be in a program that runs in the DOS session. That's because hardware protection mechanisms are inoperative in real mode. If an attempt is made to infect a program that runs in protected mode, the germ will presumably at least attempt to bypass the operating system by reading and writing the disk controller's I/O ports directly. Thus, by setting PROTECTONLY=YES

and IOPL=NO in your CONFIG.SYS file, you can make life more difficult for such nasty programs.

INTERNATIONAL AND MISCELLANEOUS

Most of the remaining directives in the Internationalization Support and Miscellaneous categories have familiar DOS counterparts or have specialized functions of little interest to us here. I'll touch on only a few of these.

As under DOS, optional device drivers are loaded with DEVICE= commands. The drivers are installed in the same order that they are named in CONFIG.SYS, with one exception: all of the drivers capable of functioning in protected mode are loaded before drivers (such as EGA.SYS) that only run in the DOS compatibility environment. The order of DEVICE= statements is sometimes very important. The pointing device driver (POINTDD.SYS) must always be loaded before any MOUSExx.SYS driver, for example, and a serial mouse driver must be loaded before a COMxx.SYS driver. Note that OS/2 processes all DEVICE= statements in CONFIG.SYS before it processes any RUN= directives. That means you don't have to worry about launching a background process that relies on a device whose driver hasn't yet been loaded into the system.

The BUFFERS= and DISK-CACHE= directives control the internal caching of disk sectors at different levels within the system. The buffers allocated with the BUFFERS= statement are managed at a relatively high level within the OS/2 kernel. They are bypassed



BROWSING WITH CONFIG.EXE

Key	Action
Up Arrow	Move toward start of file by one line, scrolling if necessary.
Down Arrow	Move toward end of file by one line, scrolling if necessary.
PgUp	Move toward start of file by one screen length of lines.
PgDn	Move toward end of file by one screen length of lines.
Home	Go to start of file.
End	Go to end of file.
A	Go to end of file and insert one empty line; make that line current line; enter edit mode.
C	Enter edit mode for current line.
D	Delete current line.
I	Insert one empty line before current line; make that line current line; enter edit mode.
R	Discard all changes made since program was started; reread and display original file contents.
X	Write modified file and exit from program.
Esc	Discard all changes and exit from program.

Figure 3: CONFIG.EXE uses the command keys shown above when in its browse mode.

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when a program requests a read larger than 512 bytes. The buffers allocated with `DISKCACHE=` are controlled by the kernel routines that talk to the disk device driver and thus can speed up read operations of any size. In most cases, then, you'll get better results by giving memory to `DISKCACHE=` rather than to `BUFFERS=`.

The directives `FILES=` and `LAST-DRIVE=`, which are used in `DOS CONFIG.SYS` files, are ignored if they are found in `OS/2 CONFIG.SYS` files. Under `DOS`, both of these directives are used during the boot process to allocate memory for operating-system tables. Under `OS/2`, which is a virtual-memory system, operating-system tables can be moved and expanded whenever necessary, so there is no need to preallocate a fixed amount of memory for them.

THE CONFIG.EXE UTILITY

Having now looked at the components of the `OS/2 CONFIG.SYS` file, we can turn our attention to how the *PC Magazine* `CONFIG.EXE` utility handles them. The command-line syntax is simply

```
CONFIG [pathname] [options]
```

If the optional *pathname* is omitted, `CONFIG.EXE` assumes that the `CONFIG.SYS` file is in the root directory of the system's boot drive. If the file is not found or is designated read-only, `CONFIG.EXE` exits with an error message.

`CONFIG.EXE` comes up in *browse mode*, which recognizes the command keys shown in Figure 3. In this mode you can move about in `CONFIG.SYS` with the Up Arrow, Down Arrow, PgUp, PgDn, Home, and End keys. You can also delete the current line with the D key, and restore the display to its original state with the R key. The current line is displayed in reverse video. Figure 4 shows the `CONFIG` utility running in a Presentation Manager text window. It can also run in a full-screen session.

Pressing the A (Add line at end), C (Change current line), or I (Insert line before current line) command key switches you to *edit mode*. In this mode you can make modifications to `CONFIG.SYS`. While in edit mode, either the current directive's name or its value is highlighted,

and you can toggle between these two fields with Tab and Shift-Tab.

As described in Figure 5, while editing the name field, you can use only the Up Arrow and Down Arrow keys, which cycle through the valid possibilities. You can't just type in an arbitrary string. This protects you from misspellings and from my own besetting blunder, which is to type `DRIVER=` instead of `DEVICE=`.

When editing in the value field of a directive, on the other hand, you have a fairly powerful little editor at your disposal. Its command keys are listed in Figure 6. A blinking cursor is displayed at the current editing point, and you can move the cursor around with the Left Arrow, Right Arrow, Home, and End keys. You can delete a

character with the Del key, erase from the cursor to the end of a line with the Ctrl-End combination, and toggle between insert and overstrike modes with the Ins key. (Insert mode displays an underline cursor, while overstrike uses a block cursor.)

When editing in either the name or the value field, you can return to the browse mode at any time with the Enter or Esc keys. Hitting Enter retains the edited copy of the line, while Esc discards the changes just made; both commands prompt you for confirmation before taking any irreversible action.

After inspecting and/or editing the `CONFIG.SYS` file, you terminate `CONFIG.EXE` by pressing Esc or X (eXit) from the browse mode. Esc prompts you for

PC EDITING CONFIG.SYS NAMES	
Key	Action
UpArrow	Select and display previous directive name in alphabetical order.
DownArrow	Select and display next directive name in alphabetical order.
Tab	Move to directive value field for editing.
Enter	Accept changes to current line and return to browse mode.
Esc	Discard all changes and return to browse mode.

Figure 5: When you're editing a directive name with `CONFIG.EXE`, these command keys cycle you through the range of valid entries. All other keystrokes are rejected with a beep.

PC EDITING CONFIG.SYS VALUES	
Key(s)	Action
Left Arrow	Move cursor left one position in value field.
Right Arrow	Move cursor right one position in value field.
Home	Move cursor to beginning of value field.
End	Position cursor at end of existing text in value field.
Backspace	Move cursor left one position. If in overstrike mode, change character at new cursor position to a blank; if in insert mode, delete character under cursor.
Del	Delete character under cursor.
Ctrl-End	Erase from cursor to end of line.
Ins	Toggle between overstrike mode (underline cursor) and insert mode (block cursor).
Shift-Tab	Move to directive name field for editing.
Enter	Accept changes to current line and return to browse mode.
Esc	Discard changes and return to browse mode.

Figure 6: When editing a directive value, `CONFIG.EXE` becomes a versatile screen editor that uses the command keys shown above. Other displayable characters replace the text under the cursor (overstrike mode) or are inserted at the cursor (insert mode). Nondisplayable characters and extended keys that are not listed above are rejected with a beep.

CONFIG.C

[illegible]

CONFIG.C: The C language source code for a working but simplified version of CONFIG.EXE. The longer and more complete version of the source code, as well as a fully compiled executable file, can be downloaded from PC MacNet.

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Employer's Address: Street City State		Gross \$		Net \$	
Previous Employer		Address		Date of Employment: From To	
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PCM9-12

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CONFIG.C

```

if(argc < 2)
{
    // get name of file to edit
    // also (CONFIG.878 boot drive
    strcpy(name, "c:\\config.878");
    ConvertName(&name, &name);
    (long) ginfo = (long) gseg < 16;
    name[0] = ginfo[24] * 'a' - 1;
    // boot drive into filename
}
else strcpy(name, argv[1]);

VioSetCurType(&curInfo, 0);
cstart = curInfo.start;

modeInfo.len = sizeof(modeInfo);
VioGetMode(&modeInfo, 0);
lpg = modeInfo.rows;
lpp = modeInfo.rows - 2;
cpl = modeInfo.cols;

if(cpl < 88)
    screen = "Use display mode with at least 88 columns.";

showstrings();
// build format strings
readfile();
// read CONFIG.878 file
signon();
// display sign-on info

if(editfile())
    writefile();
// write modified file
else()
    // clear screen and wait
}

/* Edit the parsed in-memory copy of the CONFIG.878 file */
int editfile(void)
{
    edmode = SHOWED;
    structtype(&edmode);
    showpage();
    // Initialize editing mode
    // Initialize cursor state
    // Display first page
    showstatus(&help(&edmode));

    while((! kbdtst(&kbInfo, WAIT, 0))
    {
        switch(toupper(&kbInfo.chrCode))
        {
            case 'A':
                addline();
                // add new line at
                // end of file
                break;

            case 'C':
                changeline();
                // change current line
                break;

            case 'D':
                deleteline();
                // delete current line
                break;

            case 'I':
                insertline();
                // insert new line at
                // current line
                break;

            case 'R':
                // revert to original file
                if(ask("Revert to original file?") & YES) return(YES);
                break;

            case 'W':
                // wait, write file
                if(ask("Write modified file and exit?") & YES) return(YES);
                break;

            case ESC:
                // wait, don't write file
                if(ask("Quit without writing file?") & YES) return(YES);
                break;

            case 0:
                // extended keycodes
                case 88:
                    switch(&kbInfo.cmdCode)
                    {
                        case HOME:
                            curline = 0;
                            cury = 0;
                            showpage();
                            break;

                        case UP:
                            // move one line towards
                            // start of file
                            break;

                        case DOWN:
                            // move one line towards
                            // end of file
                            break;

                        case PAGEUP:
                            // move one page towards
                            // start of file
                            break;

                        case PAGEDOWN:
                            // move one page towards
                            // end of file
                            break;

                        case END:
                            // go to end of file
                            curline = totall;
                            cury = min(cpl-1, totall);
                            showpage();
                            break;

                        default:
                            // unrecognized extended key
                            break;
                    }
                }
            }

            default:
                // unrecognized normal key
                break;
            }
        }

        // Add a new line at the end of file, allocating heap space for
        // two null strings: the directive's name and its value
        void addline(void)
        {
            if(totall == MAXLEN)
                // don't allow add operation
                // if line array already full
                return;

            curline = totall++;
            newlines();
            // create an empty line
            cury = min(curline-1, lpg-1);
            // adjust cursor position
            showpage();
            // update display
            changeline();
            // now edit the new line
        }

        // Insert a new (empty) line before the current line, allocating heap
        // space for two null strings: the directive's name and its value
        void insertline(void)
        {
            int i;
            // scratch variable

            if(totall == MAXLEN)
                // don't allow insert if
                // line array already full
                return;

            if(curline == 0)
                // if empty file, use
                // the add new line
                return;
            else
            {
                for(i = totall-1; i >= curline; i--)
                    // OK to insert...
                    // move current line and
                    // subsequent lines down
                    totall++;
                newlines();
                // current becomes empty line
                showpage();
                // update the display
                changeline();
                // now edit the new line
            }
        }

        // Create a new (empty) line. Heap space is allocated for
        // two null strings: the directive's name and its value
        void newlines(void)
        {
            if((! (curline[0] = malloc(strlen("")+1)) & YES) ||
                (! (curline[1] = malloc(strlen("")+1)) & YES))
                screen = "Out of heap space.";

            strcpy(curline[0], "");
            // allocate space from heap
            // name and value strings
            strcpy(curline[1], "");
            // assign null strings as
            // initial name and value
        }

        // Change the name and/or value strings of the current line
        void changeline(void)
        {
            char buff[256];
            int i;
            // scratch buffer
            // scratch variable

            edmode = SHOWED;
            insflag = FALSE;
            // start in same field
            // insert initially off

            memset(valstr, 0, sizeof(valstr));
            strcpy(namestr, curline[0]);
            // make local copies of
            // current name and value strings
            strcpy(valstr, curline[1]);

            dirn = skname(namestr);
            // initialize name string index
            valn = 0;
            // initialize value string index

            if(dirn == 0)
                // if unrecognized name...
                if(ask("Unknown directive. Erase it?")
                {
                    dirn = 0;
                    strcpy(namestr, "");
                    // optionally zap next
                    strcpy(valstr, "");
                }
            }

            highlight(edmode);
            showstatus(&help(&edmode));
            // position highlight
            // update help line

            while(YES)
            {
                i = max(0, valn - (cpl - 3500 - 1));
                // display current line
                printf(buff, format, curline, namestr, valstr);
                VioSetCurType(&curInfo, min(strlen(buff), cpl, cury, 0, 0));
            }
        }
    }
}

```

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CONFIG.C

3 of 5

```

if(edmode == EDVAL) // position blinking cursor
{
    curs = min(PICW-walls, up-1);
    setcursor(curs, curs);
}

ShowChar(hbinfo, WAIT, 0);

switch(hbinfo.charcode)
{
    case ESC: // Escape key
        if(! sub("placed changes to this line")) break;
        edmode = EDNONE;
        showline(curs, curs); // restore previous text
        setcursor(edmode); // hide blinking cursor
        highlight(edmode); // highlight active line
        showstatus(help(edmode)); // display help line
        return;

    case ENTER: // Enter key
        if(! sub("accept changes to this line")) break;
        edmode = EDNONE;

        // copy new text to heap
        lncurs[i] = rwcurs[i]; strncat(memstr, v);
        lncurs[i+1] = rwcurs[i+1]; strncat(memstr, v);
        if(lncurs[i] == NULL) { lncurs[i+1] = NULL;
            strcat(memstr, "\n");
            strcpy(lncurs[i], memstr);
            strcpy(lncurs[i+1], memstr);
        }

        showline(curs, curs); // restore previous text
        setcursor(edmode); // hide blinking cursor
        highlight(edmode); // highlight active line
        showstatus(help(edmode)); // display help line
        return;

    case TAB: // Tab key
        if(edmode == EDVAL) { dirx <= 0; hlep(); }
        else // if not there already
        {
            edmode = EDVAL; // move to value field
            val = 0; // init. index to string
            curs = PRCW; // set cursor position
            setcursor(curs, curs); // and cursor appearance
            setcursor(edmode); // hide blinking cursor
            highlight(edmode); // highlight value field
            showstatus(help(edmode)); // display help info
        }
        break;
    case 0: // extended key code
    case F1: // extended key code
        if(hbinfo.charcode == BACKTAB)
        {
            if(edmode == EDNAME) hlep(); // backtab key
            else
            {
                val = 0; // left-align value string
                edmode = EDNAME; // move to name field
                setcursor(edmode); // hide blinking cursor
                highlight(edmode); // highlight name field
                showstatus(help(edmode)); // display help info
            }
            break;
        }
        default: // other keys field-specific
            if(edmode == EDNAME) changeName();
            else changeVal();
        }
    }
}

/* Handle editing of directive's name field only */
void changeName(void)
{
    if(hbinfo.charcode == 0) { hbinfo.charcode = F1; }
    switch(hbinfo.charcode)
    {
        case DOWN: // advance to next
            dirx++; // directive name
            if(dirx == DIRMN) dirx = 0;
            strcpy(memstr, directives[dirx]);
            break;

        case UP: // back up to previous
            dirx--; // directive name
            if(dirx < 0) dirx = DIRMN - 1;
            strcpy(memstr, directives[dirx]);
            break;

        default: // unrecognized extended key
            hlep();
    }
}
// else hlep(); // unrecognized normal key

/* Handle editing of directive's value string only */
void changeVal(void)
{
    int vlen = strlen(valstr); // get current length

    while(vlen > 0 && (valstr[vlen-1] == '\0'))
        valstr[vlen-1] = 0; // trim trailing blanks

    if(hbinfo.charcode == 0) { hbinfo.charcode = F1; }
    switch(hbinfo.charcode)
    {
        case RIGHT: // move right one character
            val = min(vlen-1, vlen);
            break;

        case LEFT: // move left one character
            val = max(vlen-1, 0);
            break;

        case HOME: // go to start of line
            val = 0;
            break;

        case END: // go to end of line
            val = vlen;
            break;

        case CTRLEND: // clear to end of line
            memset(valstr+val, 0, sizeof(valstr)-val);
            break;

        case INS: // toggle insert flag
            hlep();
            setcursor(edmode);
            break;

        case DEL: // delete char under cursor
            strcpy(valstr+val, valstr[val+1]);
            break;

        default: // unrecognized extended key
            hlep();
    }

    if(hbinfo.charcode >= 0) { // printable ASCII character
        if(hbinfo.charcode <= 0x1F) { // and string not full
            (val < sizeof(valstr)-1) &&
            (memfry && (vlen > sizeof(valstr)-2));

            if(insert) // if insert on, open up string
                memmove(valstr+val+1, valstr[val], sizeof(valstr)-val-1);
            valstr[val+1] = hbinfo.charcode; // store new character
        }
        else if(hbinfo.charcode == 0) { // backspace key and not
            (val == 0); // at start of line?
            {
                val--; // back up one character
                if(insert)
                    memmove(valstr[val], valstr[val+1], sizeof(valstr)-val-1);
                else valstr[val] = 0;
            }
            else hlep(); // unrecognized normal key
        }

        /* delete the current line, also releasing its heap space */
        void delatime(void)
        {
            int i; // scratch variable
            if(vlen == 0) // bail out if no lines exist
            {
                hlep();
                return;
            }

            free(lncurs[i]); // give back heap memory
            free(lncurs[i+1]);

            for(i = curs; i < (totin-1); i++)
            {
                lncurs[i] = lncurs[i+1]; // close up array of
                lncurs[i+1] = lncurs[i+2]; // pointers to parsed lines
            }

            totin--; // adjust total line count
            curs = max(0, min(curs, totin-1)); // ensure current line valid
            if(totin < lpp) // adjust current line and
            { // current position as needed
                curs = min(curs, totin-1);
                curs = min(curs, lpp-1);
            }
            else if((totin-curs) < (lpp-curs))
                curs = min(curs+1, lpp-1);

            showpage(); // update the display
        }

        /* Restore in-memory copy of CONFIG.BYB file to its original state */
        void restore(void)
        {
            int i; // scratch variable
            for(i = 0; i < totin-1; i++)
            {
                free(lncurs[i]); // give back heap memory
                free(lncurs[i+1]);
            }

            redefline(); // re-read the original file
            showpage(); // update the display
        }
    }
}

```


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Ray Duncan

CONFIG Command

September 12, 1989 (Utilities)

Purpose:

A full-screen editor for inspecting and modifying the directives contained in an OS/2 CONFIG.SYS file.

Format:

CONFIG [*pathname*]

Remarks:

The optional *pathname* parameter may be specified if the OS/2 CONFIG.SYS file is located somewhere other than the root directory of the boot drive. CONFIG.EXE will exit if the file is not found or if its read-only attribute is set.

Entry into and departure from CONFIG.EXE are always made from its browse mode. When exiting, pressing Esc discards any changes made during the session; pressing X (eXit) saves a modified CONFIG.SYS file and renames the previous CONFIG.SYS to a .BAK extension. Confirming prompts are used with all crucial actions.

In browse mode, the entire line is highlighted in reverse video, and movement through the CONFIG.SYS file is made with the Up Arrow, Down Arrow, PgUp, PgDn, Home, and End keys. Pressing D will delete an entire line, and pressing R will restore it in browse mode.

Edit mode is entered by pressing either A (Add line at end of file), C (Change current line), or I (Insert line before current line). In edit mode, either the *name* field or the *value* field is highlighted and available for modification. In the directive PRIORITY=DYNAMIC, for example, PRIORITY is the *name* and DYNAMIC is the *value*. The Tab key and the Shift-Tab combination toggle between the two fields.

During editing of the *name* field, the Up Arrow and Down Arrow keys cycle through an alphabetical listing of all valid directives. No other entries can be made in this field. In the *value* field, however, CONFIG.EXE becomes a normal editor, with insert and overstrike modes toggled by the Ins key. Character deletions are made with the Del key, and Ctrl-End deletes to the end of the line. In insert mode, the Backspace key deletes the character under the cursor, but in overstrike mode, it replaces the character with a blank. Cursor motion within a line is made with the Left Arrow, Right Arrow, Home, and End keys. Press Enter to accept, or Escape to discard, changes made to a line and return to browse mode.

Note: CONFIG.EXE and its source-code file, CONFIG.C (written in Microsoft C, Version 5.1), may be downloaded from PC MagNet. The CONFIG.C source file printed with the article is a shortened form that omits on-line help and syntax checking for each directive.

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from the *global information segment*. The procedure `makestrings()` is called to build formatting strings (based on the screen's width) that will be used by the rest of the program. Next, the `signon()` procedure is called to show the program name and the edited filename, followed by `readfile()`, which brings the file that is to be edited into memory.

The work of the `readfile()` routine is somewhat more complex than you might expect. I decided to parse each `CONFIG.SYS` line into its name and value portions when the file was read in originally rather than each time a line was displayed or edited. This procedure ensures that the parsing overhead occurs only once. (It also hides the time needed for parsing inside the overall time it takes to fetch the file from disk and to perform all of the other initialization required by the program and expected by the user!)

After breaking each line apart at the first equals sign (=) or blank delimiter, `readline()` copies the individual pieces into memory that it allocates from the heap. `Readline()` also builds an array named `ln[]`, which holds pointers to the pairs of heap objects representing each line of text. This array is the fundamental data structure relied on by all of the other routines in the program.

After the file has been successfully read, `main()` calls the major procedure `editfile()` to process the user's keystrokes. `Editfile()` consists largely of an endless loop that reads a key and then either dispatches an appropriate subroutine with a switch{} control structure or complains with a beep if the key is not recognized in the current mode. `Editfile()` returns a `TRUE` or `FALSE` flag to `main()` indicating whether or not the file should be written. This flag is, of course, dependent on whether the user entered an `Esc` or an `X` command to leave browse mode.

`Writefile()` is the last major routine called by `main()`. It creates a temporary file to receive the output, then scans through the `ln[]` array, retrieving the name and value for each line, inserting a blank or = between them as appropriate, and writing the reconstructed line out to disk. If the entire file is successfully written, `writefile()` deletes any preexisting .BAK file, renames the input (original) file with a .BAK extension, and finally renames the output file

that contains the edited text with the original file's name.

Of the remaining routines, the most interesting are those called by `editfile()` to perform the actual editing: `addline()`, `insertline()`, `newline()`, `deleteline()`, and `changeline()`. Of this group, `changeline()` is the most complex, since it must decode editing keys, maintain the heap, and update the display properly as modifications are made. It must even provide for scrolling the value field of a directive horizontally if the field won't all fit on the screen at once. `Changeline()` delegates some of its hard work to the routines `changename()` and `changeval()`, whose functions are obvious from their names.

For the most part, the rest of the procedures in `CONFIG.C`—`lineup()`, `linedown()`, `pageup()`, `pagedown()`, and so on—are necessary but somewhat tedious exercises in bookkeeping for the current line, screen contents, and cursor position. Their operation is clearly documented in the source code and needs no further discussion.

As you look through the `CONFIG.C` source code, you'll probably notice that it contains very little that distinguishes it as an OS/2 program. There is no explicit use of threads, child processes, or interprocess communications facilities, and the standard C functions for file access and memory management are employed throughout the `CONFIG.C` source code.

`CONFIG.EXE` does, however, make extensive use of the kernel's VIO subsystem, which also demonstrates how simple it is to make OS/2 calls directly from a high-level language. Such kernel functions as `VioWrtnCharStr`, `VioWrtnAttr`, `VioSetCurPos`, `VioScrollUp`, and `VioReadCharStr` are used to obtain screen throughput far superior to what could be achieved using the C runtime library as an intermediary.

That, at least, is the case for the version of `CONFIG.C` printed here—the lean, mean version with minimal syntax checking. If you download `CONFIG.C` or `CONFIG.EXE` from PC MagNet, you'll get the "long" variant—a much more elaborate version of the utility that has on-line help for each directive and uses multiple threads to exhaustively check the syntax of each directive "in the background." As I said at the outset, modems are really becoming a necessity. ■

Ray Duncan is a contributing editor of PC Magazine.



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by
Charles Petzold

Environments

Everyone knows that graphics mode is significantly slower than character mode. Programs running in character mode can snap to the screen almost instantly, especially if they write directly to video memory or use a fast character mode interface such as the OS/2 Vio functions. We've all grown accustomed to this snap, and it's what we miss most when moving to a graphics environment.

The reason for the speed of character mode is no mystery: updating an entire 25-line by 80-column display requires writing only 4,000 bytes (2 bytes for each character) into video memory. But a 16-color 640- by 480-pixel display such as the VGA requires 153,600 bytes to update the whole screen. That's quite a difference.

For at least some people, the performance degradation inherent in graphics remains the single most significant objection to a graphical user interface. True, most new video adapters in the next decade will feature some sort of coprocessing or hardware-assisted drawing. That will certainly help—then.

But until graphics mode becomes perceptually as fast as character mode, programmers working in an environment such as the OS/2 Presentation Manager have their work cut out for them. Program acceptance requires that you spend some time optimizing your Presentation Manager code for good video response.

This is one of the subjects we'll explore as we look at PMASC, a Presentation Manager version of Jeff Prossie's ASC program (*PC Magazine*, March 10, 1987). PMASC displays a scrollable ASCII (or EBCDIC) table in a window. Since the Presentation Manager supports 11 ASCII and EBCDIC codepages, PMASC lets you pick the codepage you want to view.

Figure 1 shows several copies of PMASC running under the OS/2 Presentation Manager, each with a different codepage selected. The two on the left are displaying ASCII codepages; the one on the right shows an EBCDIC codepage. (If you downloaded last issue's files from PC

Graphics-based programs lag behind those running in character mode. A look at the C source code of PMASC reveals how you can optimize Presentation Manager programs to improve video response time.

MagNet, you'll notice that the current PMASC window looks a little different from the earlier version. I made an enhancement to display the current selected codepage at the top of the window.)

Last time we looked at the ancillary

files you use to create PMASC.EXE. In this column, we'll examine the most important file: PMASC.C, the C source code listing.

HABIT FORMING

Programmers who work in a character-mode environment like DOS often develop habits they should not carry over to their work in a graphical environment. Since character mode is so fast, programmers sometimes update the entire screen (or a pop-up window on the screen) if only one character changes. This is usually the easiest approach, for the programmer can ignore all the special cases of how the display may change.

Updating an entire window is usually the easiest approach when programming for the Presentation Manager, too. But in graphics mode, the performance degradation is considerable. Thus, you must take a more careful approach to updating the window and update only what is necessary. This usually makes the painting code in your programs longer and more complex, of course, but the results are definitely worth the extra effort.

I won't try to tell you that even the current PMASC screen updating logic is as fast as it could be. But it's sure a lot faster

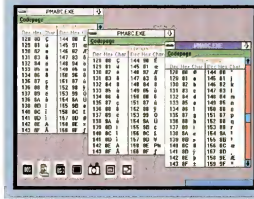


Figure 1: By running multiple copies of PMASC under the OS/2 Presentation Manager you can simultaneously display several ASCII and EBCDIC codepages.

Environments

than it was in the first version I wrote! As we look at the program together, I'll discuss how I originally wrote it and what changes I made to improve it.

PROGRAM INITIALIZATION

The PMASC.C file is shown in Figure 2. The main function is fairly normal. You'll notice that the FCF (frame creation flag) identifiers include FCF_ICON and FCF_MENU, indicating that the program has an icon and menu stored as resources in the PMASC.EXE program. The FCF_VERTICALSCROLL identifier indicates that a vertical scrollbar window should be created to the right of the client window.

ClientWndProc is the window proce-

dures that processes all messages to the client window. During the WM_CREATE message, PMASC performs a variety of initialization jobs. You'll recall from the last issue that PMASC can display an ASCII (or EBCDIC) character set using any of GPI's 11 codepages. Using GpiQueryCp, PMASC obtains the default codepage ID number and stores it in usDefCodePage. (In most cases, this default codepage ID will be 850). The ID is also stored in the variable usSelCodePage, which will be used later to store the codepage ID the user has selected from the menu.

PMASC then uses GpiQueryFontMetrics to obtain some of the text dimensions (average character width, the vertical line spacing, and the depth of the descenders) of the default system font. These are used later to calculate PMASC's window size and to draw text in the window. PMASC

then obtains window handles to its scrollbar and menu windows and initializes these windows.

The scrollbar is used to scroll the ASCII table within the window. At any one time the window displays 32 codes (in both decimal and hexadecimal) and the characters corresponding to these codes. When the scrollbar slider is at the top of the scrollbar, the window should show codes 0 through 31. When the slider is moved to the bottom of the scrollbar, it should show codes 224 through 255.

Thus, the scrollbar should have 225 possible positions, numbered 0 through 224, corresponding to the code in the upper-left corner of the window. The first WinSendMessage call during WM_CREATE sends an SBM_SETCROLLBAR message to the scrollbar. This message tells the scrollbar window to set the range to 0

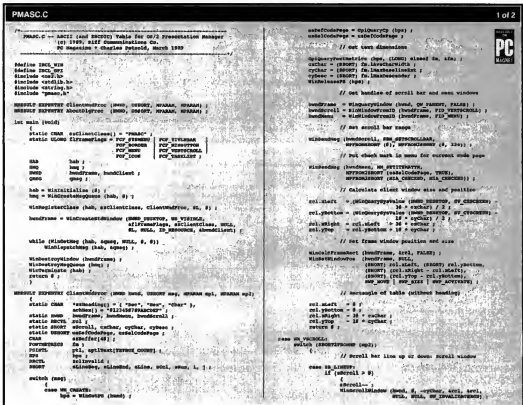


Figure 2: The PMASC.C source code listing. If you don't have the Microsoft C compiler, Version 5.1 or later, the executable PMASC.EXE can be downloaded from PC MagNet (see the sidebar "CONFIG by Modem" in the Utilities section).

```

    }
    break ;

case SS_LINEDOWN:
    if (sScroll < 224)
    {
        sScroll++;
        WinScrollWindow (hwnd, 0, cyChar, sCrl, sCrl,
            NULL, NULL, SW_INVALIDATERGN);
    }
    break ;

// Scroll bar page up or down: Invalidate window
case SB_PAGEUP:
    if (sScroll > 0)
    {
        sScroll = max (0, sScroll - 32);
        WinValidateRect (hwnd, sCrl, FALSE);
    }
    break ;

case SB_PAGEDOWN:
    if (sScroll < 224)
    {
        sScroll = min (224, sScroll + 32);
        WinValidateRect (hwnd, sCrl, FALSE);
    }
    break ;

case SS_SLIDERPOSITION:
    if (sScroll != SHORTIFROMUP (mp2))
    {
        sScroll = SHORTIFROMUP (mp2);
        WinValidateRect (hwnd, sCrl, FALSE);
    }
    break ;

default:
    return 0 ;
}

WinSendMsg (hwndScroll, SBM_SETPOS,
    MPFROMSHORT (sScroll), NULL);
return 0 ;

// Keyboard messages: Minic scroll bar
case WM_CHAR:
    switch (CHARMSG(msg)->key)
    {
        case VK_HOME:
            return WinSendMsg (hwnd, WM_VSCROLL, NULL,
                MPFROMSHORT (0, SS_SCROLLPOSITION));
        case VK_END:
            return WinSendMsg (hwnd, WM_VSCROLL, NULL,
                MPFROMSHORT (224, SS_SLIDERPOSITION));
        default:
            return WinSendMsg (hwndScroll, msg, mp1, mp2);
    }

// Menu messages: Invoke "About" box or set new code page
case WM_COMMAND:
    if (COMMANDMSG(msg)->cmd == IDM_ABOUT)
        WinDlgBox (hwnd, DESKTOP, hwnd, AboutDlgProc,
            NULL, IDD_ABOUT, NULL);
    else
    {
        WinSendMsg (hwndMenu, WM_SETITEMDATA,
            MPFROM2SHORT (uselCodePage, TRUE),
            MPFROM2SHORT (KIA_CHECKED, 0));

        hps = WinGetTS (hwnd);
        OptSetCp (hps, COMMANDMSG(msg)->cmd);
        uselCodePage = OptQueryCp (hps);
        OptSetCp (hps, uselCodePage);
        WinReleaseTS (hps);

        WinSendMsg (hwndMenu, WM_SETITEMDATA,
            MPFROM2SHORT (uselCodePage, TRUE),
            MPFROM2SHORT (KIA_CHECKED, KIA_CHECKED));

        WinValidateRect (hwnd, NULL, FALSE);
        return 0 ;
    }

case WM_PAINT:
    hps = WinBeginPaint (hwnd, NULL, sCrlInvald);
    WinFillRect (hps, sCrlInvald, CLR_WHITE);

    // Draw lines in window
    OptSetColor (hps, CLR_BLACK);

    ptl.x = rcl.xRight / 2; ptl.y = 0; OptMove (hps, Aptl);
    ptl.y = rcl.yTop + cyChar; OptLine (hps, Aptl);
    ptl.x = 0; ptl.y = rcl.yTop; OptMove (hps, Aptl);
    ptl.x = rcl.xRight; OptLine (hps, Aptl);

    // Determine text line range within lovelid rectangle
    sLineSeg = (SHORT) (sCrl - (rclInvald.yTop - cyChar) / cyChar);
    sLineEnd = (SHORT) (16 - rclInvald.yBottom - cyChar);

    for (sLine = sLineSeg; sLine < sLineEnd; sLine++)
    {
        ptl.y = (15 - sLine) * cyChar + cyBase;

        // Display codepage name
        if (sLine == -2)
        {
            OptSetColor (hps, CLR_RED);
            WinSendMsg (hwndMenu, WM_OVERTITMETEXT,
                MPFROM2SHORT (uselCodePage,
                    (SHORT) selseof (ssBuffer)),
                ssBuffer);

            // Strip out "" character
            for (i = 0, j = 0; ssBuffer[j] != '\0'; j++)
            {
                if (ssBuffer[i] != '"')
                    ssBuffer[j++] = ssBuffer[i-1];
            }

            // Display centered text
            OptQueryTextBox (hps, (LONG) strlen (ssBuffer),
                ssBuffer, TEXTBOX_COUNT, sptlText);

            ptl.x = (rcl.xRight - sptlText[TEXTBOX_COUNT].x) / 2;
            OptCharStringAt (hps, Aptl, (LONG) strlen (ssBuffer),
                ssBuffer);
        }

        // Display heading
        else if (sLine == -1)
        {
            OptSetColor (hps, CLR_BLUE);
            for (sCrl = 0; sCrl < 6; sCrl++)
            {
                ptl.x = cyChar * (5 + sCrl * sCrl * 2 / 4 * 2);

                OptCharStringAt (hps, Aptl,
                    (LONG) strlen (ssHeading[sCrl * 3]),
                    ssHeading[sCrl * 3]);
            }
        }
        else
        {
            OptSetColor (hps, CLR_BLACK);
            for (sCrl = 0; sCrl < 6; sCrl++)
            {
                ptl.x = cyChar * (5 + sCrl * sCrl * 2 / 4 * 2);
                sNum = sCrl * sLine * (sCrl > 2 ? 16 : 0);

                // Decimal ASCII/ESC/DIC code
                if (sCrl % 3 == 0)
                {
                    ssBuffer[0] = (CHAR) ('0' + sNum / 10);
                    ssBuffer[1] = (CHAR) ('0' + sNum % 10);
                    ssBuffer[2] = (CHAR) ('0' + sNum % 10);
                    ssBuffer[3] = '\0';
                }
                // Hexadecimal ASCII/ESC/DIC code
                else if (sCrl % 3 == 1)
                {
                    ssBuffer[0] = ' ';
                    ssBuffer[1] = sNum >> 4;
                    ssBuffer[2] = sNum >> 4 & 15;
                    ssBuffer[3] = '\0';
                }
                // ASCII/ESC/DIC character
                else
                {
                    ssBuffer[0] = ' ';
                    ssBuffer[1] = (CHAR) sNum;
                    ssBuffer[2] = '\0';
                }

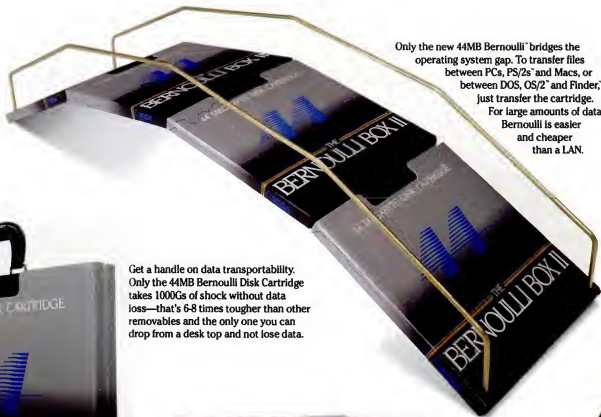
                OptSetCp (hps, uselCodePage);

                OptCharStringAt (hps, Aptl,
                    (LONG) strlen (ssBuffer), ssBuffer);

                OptSetCp (hps, uselCodePage);
            }
        }
        WinEndPaint (hps);
        return 0 ;
    }
    return WinDefWindowProc (hwnd, msg, mp1, mp2);
}

RESULT EXPENTRY AboutDlgProc (HWND hwnd, USHORT msg, LPARAM mp1, LPARAM mp2)
{
    switch (msg)
    {
        case WM_COMMAND:
            switch (COMMANDMSG(msg)->cmd)
            {
                case DID_OK:
                    case DID_CANCEL:
                        WinDismissDlg (hwnd, TRUE);
                        return 0 ;
            }
            break ;
    }
    return WinDefDlgProc (hwnd, msg, mp1, mp2);
}

```

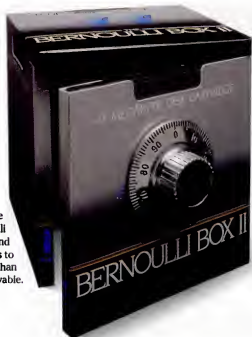


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CIRCLE 378 ON READER SERVICE CARD

Environments

through 224 and the initial position of the scrollbar to 0 (the top).

PMASC's menu allows the user to select the codepage of the character set to be displayed in the window. A check mark next to the item indicates the currently selected codepage. The second `WinSendMsg` call during `WM_CREATE` sends an `MM_SETITEMATTR` message to the program's menu to set this check mark.

When defining PMASC's menu in the `PMASC.RC` resource script file last time, I used the codepage ID numbers themselves for the menu ID numbers in the menu list of available codepages. This simplifies the menu checkmarking logic in PMASC because PMASC can use the codepage ID directly when it tells the menu window which item should have the check mark.

Next, PMASC calculates the size and initial position of its client window. The window is positioned in the center of the screen, and it has a height of 18 character heights and a width of 36 average character widths. The height is obvious because there are 18 lines of text in the window. The width of 36 average character widths was determined by experimentation.

After calling `WinSetWindowPos` to set the window position and size, PMASC then initializes the fields of `rc1` (a `RECT` rectangle structure) to contain the coordinates of the ASCII table without the two heading lines. As we'll see shortly, this is used when scrolling the window.

SCROLLBAR MESSAGE PROCESSING

When you use the mouse to click on PMASC's scrollbar (or when you drag the scrollbar slider with the mouse), the scrollbar window notifies the client window by sending it `WM_VSCROLL` messages. These messages are processed within `ClientWndProc`. The `mp2` message parameter contains a code that indicates the action has been performed. You use identifiers defined in `PMWIN.H` beginning with the prefix `SB` ("scrollbar") to determine what this action was.

Most commonly, a program that contains a scrollbar processes five of these action identifiers. Specifically, `SB_LINEUP` and `SB_LINEDOWN` indicate mouse clicks on the top and bottom arrows of the scrollbar. The `SB_PAGEUP` and `SB_PAGEDOWN` identifiers indicate

mouse clicks on the slider track area, above and below the slider. The `SB_SLIDERPOSITION` identifier signifies that you've dragged the slider with the mouse.

A program usually responds to scrollbar messages by setting the new position of the scrollbar (this involves sending the scrollbar an `SBM_SETPOS` message) and invalidating all or part of the client window. Invalidating the window causes a `WM_PAINT` message to be posted to the window. The window procedure updates the window during the `WM_PAINT` message.

I use the static variable `sScroll` in order to keep track of the scrollbar position. This variable is initialized to 0 and can range from 0 to 224, corresponding to the code displayed in the upper-left corner of the window.

So, for an `SB_LINEUP` action, `sScroll` must be decremented by 1, and for an `SB_LINEDOWN` action, `sScroll` must be incremented by 1. For `SB_PAGEUP` or `SB_PAGEDOWN`, `sScroll` must be incremented or decremented by 32, to show the next set of 32 codes in the window. For `SB_SLIDERPOSITION`, the `mp2` message parameter contains the new value of `sScroll`. In all cases, `sScroll` must be limited to the range 0 to 224.

In my first version of PMASC, I simply calculated the new value of `sScroll` during the `WM_VSCROLL` message, set the new scroll position, and invalidated the entire window using the following handy function:

```
WinInvalidateRect (hwnd, NULL, FALSE);
```

During the `WM_PAINT` message, the entire window was erased and then painted again.

If this were a character-mode program, I'd have been done with it. But in graphics mode—especially on slow machines like my 8-MHz AT—I found it quite annoying that I had to watch the entire window being redrawn whenever I scrolled up or down a line.

The solution here was to use the `WinScrollWindow` function for the `SB_LINEUP` and `SB_LINEDOWN` actions. The rectangle that is scrolled is given by the `rc1` `RECT` structure. You'll recall that during the `WM_CREATE` message, PMASC sets the fields of this structure to the coordinates of the table excluding the two heading lines at the top. The window is scrolled by either `cyChar` (the pixel

height of a line of text) or `-cyChar`. The `SW_INVALIDATERGN` parameter to `WinScrollWindow` indicates that the area uncovered by the scroll should be invalidated. This decreases the amount of redrawing that has to be done during the `WM_PAINT` message.

For `SB_PAGEUP`, `SB_PAGEDOWN`, and `SB_SLIDERPOSITION`, I invalidate the entire `rc1` rectangle. In this case, the whole table (except the heading) has to be redrawn during the `WM_PAINT` message.

A scrollbar that is created as part of a standard window (as in PMASC) will not normally receive WM_CHAR messages.

A KEYBOARD INTERFACE

Of course, people who prefer to use the keyboard rather than the mouse must also have a way to scroll the PMASC window. A Presentation Manager program is notified of keystrokes through the `WM_CHAR` message.

Scrollbar windows contain their own `WM_CHAR` message processing. They can respond to the Arrow keys and the `PgUp` and `PgDn` keys. (Scrollbars do not respond to the Home and End keys, however.) But a scrollbar that is created as part of a standard window (as in the PMASC program) will not normally receive these `WM_CHAR` messages. This lack of communication happens because only one window—the window with the input focus—receives a `WM_CHAR` message for a particular keystroke. When the PMASC program is active, the focus window is the client, so it is the client window rather than the scrollbar window that will receive these `WM_CHAR` messages.

Fortunately, it's fairly easy for PMASC's client window to send these `WM_CHAR` messages to the scrollbar window for processing by the scrollbar. The requisite line is

```
WinSendMsg (hwndscroll, msg, mp1, mp2);
```

Environments

To enable the Home and End keys also in PMASC, I check the virtual key code in the WM_CHAR message for VK_HOME and VK_END values. In these cases, I send the client window procedure a WM_VSCROLL message with an SB_SLIDERPOSITION action and a scroll value equal to 0 (for VK_HOME) or 224 (VK_END). These messages are processed the same way as the real scrollbar messages.

MENU COMMANDS

PMASC's menu performs two functions: it allows the user to change the codepage to be shown, and it can display a dialog box containing PMASC's copyright notice and other information.

A menu sends WM_COMMAND messages to indicate that the user has made a menu selection. The WM_COMMAND section of ClientWndProc handles these messages. PMASC uses the COMANDMSG macro to get the menu item ID of the menu item selected by the user. If this ID is IDM_ABOUT, then PMASC displays the program's dialog box.

Otherwise, the menu item ID is a codepage ID number. PMASC begins by sending the menu window a WM_SETITEM-ATTR message to remove the check mark from the currently selected codepage menu item. The next step would normally be to save the new codepage ID in usSelCodePage and send another WM_SETITEM-ATTR message to the menu to put a check mark on the item just selected.

However, just to be on the safe side, I check whether the codepage is valid. I first pass the selected codepage ID to GpiSetCp and then call GpiQueryCp to get the current codepage in the presentation space. It is this codepage that is used in the WM_SETITEMATTR message to set the check mark. This little routine avoids checkmarking a codepage on the menu that may not be supported.

PAINTING THE WINDOW

All PMASC window drawing occurs during the processing of the WM_PAINT message. The window procedure receives this message whenever part of the window is invalid and must be updated. In normal PMASC use, most such WM_PAINT messages will be generated when you scroll through the table, either using the

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Environments

scrollbar or the keyboard.

The lazy approach to WM_PAINT message processing is to simply repaint the entire window, even if only a part of the window is invalid. When you call WinBeginPaint to begin WM_PAINT message

processing, however, the Presentation Manager sets a clipping rectangle to encompass the invalid area of the window. Using the presentation space handle returned from WinBeginPaint, you cannot draw outside this rectangle. This helps speed up window painting.

My first version of the PMASC program invalidated the entire window during the WM_VSCROLL message and repaint-

ed the window during the WM_PAINT message. As I indicated earlier, this version obviously needed fixing. It was positively painful to watch the whole window being erased and redrawn while scrolling by a single line.

My second version, then, included the changes to WM_VSCROLL detailed above. This helped a lot. Now when the table was scrolled by a single line, only the one-line area uncovered by the scroll was invalidated. As a result, during the WM_PAINT message, only the one-line area was erased and redrawn. But while this took the edge off the pain, it was still a little too slow. The scrolling couldn't keep pace with the typematic repeats of the keyboard Arrow keys.

To speed up the scrolling adequately called for modifications to the WM_

**The lazy approach to
WM_PAINT
processing is to
simply repaint the
entire window, even if
only part of it is invalid.**

PAINT logic. The second version of PMASC still included logic to redraw the entire window. The top line of the window required a call to GpiCharStringAt. For the other 17 lines, I used a GpiCharStringAt call for each of the six columns of text. Thus, I was calling GpiCharStringAt 103 times. However, drawing a single line in the window requires only 6 calls to GpiCharStringAt. The remaining 97 calls were unnecessary because they fell outside the clipping area set by the WinBeginPaint call.

The solution, then, was to restrict the painting to the invalid rectangle alone. This has been done in the version of PMASC presented here. The rcInval-11d RECT structure passed as the last parameter to WinBeginPaint obtains the coordinates of the invalid rectangle. From this, the sLineBeg and sLineEnd variables are calculated to obtain the range of text lines that fall within the invalid rectangle. The for loop uses the sLine value to repaint



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all the lines within the invalid rectangle. The 16 lines of the table have values of sLine from 0 (the top line) through 15; the heading showing the codepage is redrawn when sLine is equal to -2, and the column headings are redrawn when sLine is equal to -1.

Three different colors are used to display the different text in the window. The GpiSetColor function specifies a color (CLR_BLACK, CLR_RED, and CLR_BLUE) used for subsequent GPI drawing functions.

For the heading describing the codepage, the menu text of the selected codepage is obtained by sending the menu an MM_QUERYITEMTEXT message. This text string contains a tilde (~) to indicate an underlined character used in the keyboard menu interface. This is stripped out. The GpiQueryTextBox functions obtain the coordinates of the rectangle that encompasses the string as if the string were drawn at the point (0,0). This is used to center the text within the window.

For the 16 lines in the table, PMASC uses GpiCharStringAt to display the six columns of text. Earlier versions of PMASC used the sprintf function to format the decimal and hexadecimal values for display. I think I've picked up a little more speed by avoiding the sprintf function and doing my own formatting. Of course, removing sprintf decreased the size of the .EXE file, as well.

When displaying the character associated with each code, PMASC calls GpiSetCp with the usSelCodePage variable. After the GpiCharStringAt call, the codepage is returned to the default by another call to GpiSetCp with the usDefCodePage variable.

EASY STUFF, HARD STUFF

When you first looked at PMASC, you might have thought that the bulk of the program involved the codepage selection logic. Now, having looked at the code behind it, you can see that the logic that is used to support the multiple codepages is fairly small and quite straightforward. It is a characteristic of graphics mode that codepage selection is purely a software issue and that it can be easily supported within the Presentation Manager. In character mode, by contrast, codepage switching requires you to load a video board (such as

the EGA) with multiple character sets.

The hard part of the PMASC program, then, is the window-painting logic. And that's also a characteristic of graphics mode. In character mode, updating the table would probably have been fast enough no matter how inefficiently it was coded! In graphics mode, this is just not the case, so you should spend some time getting it right.

Even now, of course, I won't claim that PMASC is as fast as it could be. But I was afraid that additional optimizations would make the WML_PAINT processing inordinately long and complex and obscure the workings of the program.

If I were to try to make it still faster, I'd

Three colors are used to display the different text in the window. GpiSetColor specifies a color used for subsequent GPI drawing functions.

attempt to draw each text line using two GpiCharStringAt calls rather than six. (Why not one call for each line of text? Simple: the decimal and hexadecimal codes must be drawn with the default codepage, and the character has to be drawn with the selected codepage, so these must be done separately.)

This is not as simple as it sounds—complications arise from the fact that the system font is proportionally spaced. If you're interested in attacking the problem, however, check out the GpiQueryCharStringPosAt and GpiCharStringPosAt functions. They'll help in spacing the text columns.

AND DON'T FORGET!

If you have any questions about PMASC (or other aspects of OS/2 and Presentation Manager programming), join me in the Programming forum of PC MagNet and ask away.

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Power Programming

As we saw in the last Power Programming column, adding expanded memory support to a conventional application program is a straightforward affair. Of the 18 function calls defined in the Expanded Memory Specification (EMS), Version 3.2, and the 58 defined in EMS, Version 4.0, there are only 7 that you really need to know about. And even of those 7, only 4 are absolutely crucial to the proper operation of your program.

Using expanded memory in a device driver or TSR utility, however, presents more complications. Here, you must not be concerned only with the logic of your own program, but with protecting it against every possible use (and misuse) of expanded memory by other active programs, be they drivers, TSRs, or applications.

EMS PITFALLS FOR DRIVERS AND TSRs

When a driver or TSR gains control, the state of the system is inherently sensitive and unpredictable. In the first place, the driver or TSR was undoubtedly called as the direct or indirect result of the user's interaction with an application program, and that application may very well also be using expanded memory. Clearly, any such use of expanded memory by the foreground application must not be disturbed. Therefore, it is vitally important that the driver or TSR save the expanded memory mapping context—the association of specific logical expanded memory pages with physical locations in the CPU's address space—at entry, and restore that same context before it exits.

New functions for saving and restoring the expanded memory subsystem state have been defined with each successive revision of the EMS. These are shown in Figure 1. In EMS, Version 3.0, functions 47h and 48h provided a sort of all-or-nothing capability on a per-handle basis. Thus, if the driver or TSR owned only one expanded memory handle, it could save only one mapping context at a time.

EMS, Version 3.2, added function

**It's more complicated
to add EMS access to
drivers and TSRs than
to normal applications.
But you can see it done
in EMSCACHE.**

4Eh, which actually consists of four distinct subfunctions. This allowed a program to selectively save and restore as many mapping contexts as it had memory to put them in. This made things a lot easier for multitasking program managers, since it allowed them to associate a mapping context with each active application.

With EMS, Version 4.0, the number of expanded memory pages that could be simultaneously mapped into conventional memory became much larger, and the overhead of saving and restoring the complete mapping state grew proportionately. Consequently, function 4Fh was added to manipulate partial mapping contexts. Ver-



EMS MAPPING FUNCTIONS BY VERSION

EMS version	Expanded memory function	Cell with	Returns
3.0	Save Page Map	AH = 47H DX = EMM handle	AH = status
3.0	Restore Page Map	AH = 48H DX = EMM handle	AH = status
3.2	Save Page Map	AH = 4EH AL = 00H ES:DI = buffer	AH = status
3.2	Restore Page Map	AH = 4EH AL = 01H DS:SI = buffer	AH = status
3.2	Save and Restore Page Map	AH = 4EH AL = 02H DS:SI = restore buffer ES:DI = save buffer	AH = status
3.2	Get Size of Page Map Information	AH = 4EH AL = 03H	AH = status AL = size (bytes)
4.0	Save Partial Page Map	AH = 4FH AL = 00H DS:SI = map list ES:DI = buffer	AH = status
4.0	Restore Partial Page Map	AH = 4FH AL = 01H DS:SI = buffer	AH = status
4.0	Get Size of Partial Page Map Information	AH = 4FH AL = 02H BX = number of pages	AH = status AL = size (bytes)

Figure 1: The EMS functions for saving and restoring the expanded memory mapping context.

Power Programming

sion 4.0 also defines a raft of other new functions directly or indirectly related to page mapping. These range from mapping multiple pages with one call (optionally followed by a jump or call to code within the pages) to support for multiple sets of hardware-mapping registers. These functions are intended primarily for use by operating systems, however, so we won't worry about them further here.

When you write a driver or TSR, you must anticipate the problem presented by the fact that DOS services will be unavailable after your program is originally installed. A driver is allowed to use a limited number of DOS interrupt 21h functions during installation, but none at all thereafter. A TSR is typically activated during a hardware interrupt such as the reception of a keystroke. Since the state of DOS at the time of the interrupt cannot be known in advance, TSRs must rely on undocumented flags and structures to determine whether DOS function calls can be made safely. This all means that your driver or TSR had better do all the status checks it can and acquire all the expanded memory resources it expects ever to need, at the time it gets loaded. Interaction with the user at any later point—even to display an error message—will be much more difficult.

The last potential problem I should mention is that the amount of stack space available at the time a TSR or driver is invoked is indeterminate. Depending on the

type of function call in progress, DOS itself uses three different stacks. Applications customarily have their own stacks, whose depths are totally at the discretion of the developer. Interrupt handlers often switch to their own stacks. And, last but not least, the amount of stack space required by EMS functions varies from one Expanded Memory Manager (EMM) to another and also from one version to another. The safest strategy is for your driver or TSR always to switch to its own generously sized stack before using any of the EMS functions.

THE EMSCACHE UTILITY

I've written a simple TSR disk-caching utility called EMSCACHE.ASM, listed in Figure 2, to give you a practical example of expanded memory usage by a TSR or device driver. EMSCACHE illustrates the necessary techniques, as well as the extreme care with which you must access expanded memory from inside such a program. It demonstrates the procedure for testing for the existence and functionality of expanded memory that must be used by a driver or TSR, and it contains examples of expanded memory allocation, mapping, and the saving and restoring of mapping contexts.

On the other hand, as TSRs go, EMSCACHE is not terribly sophisticated. Although it does check for a previously loaded copy of itself and will refuse to install twice, it contains no provision for deinstallation, on-line help, reporting cache hit statistics, and all the other niceties that would characterize a commercial TSR. If

you're interested in spiffing up EMSCACHE with some of these features, there are plenty of examples in previously published *PC Magazine* utilities.

The basic concept behind any kind of cache is very simple. Any item of data that is accessed by a program—whether it be a word of memory, a disk sector, a filename, or any other object—is *far* more

**EMSCACHE gives you
a practical example of
expanded memory
usage by a TSR or
device driver.**

likely to be accessed by that program again than is another randomly selected item of the same type present in the system. A cache monitors the stream of data requests and makes a copy of each item that goes by. The copy is placed in a storage medium that is much faster than the medium where the data was originally located. Then, when the cache sees another request for the same piece of data, it intercepts the request and provides the data from its own faster storage.

Naturally, when you actually set about implementing a caching mechanism, many other more-complex issues come

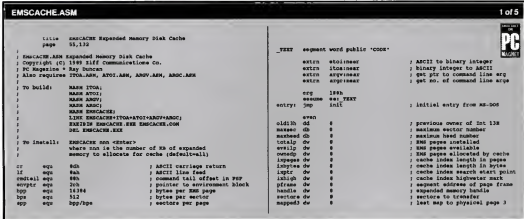


Figure 2: EMSCACHE.ASM, the source code for a simple disk cache program that uses expanded memory.

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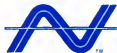
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EMSCACHE.ASM

2 of 5

```

ident db 'EMSCACHE Expanded Memory Disk Cache 1.0'
db 'or, if'
db 'Copyright (C) 1989 Xiff Davis Communications'
db 'or, if'
db 'PC Magazine "Ray Duncan"'
db 'or, if, if'
db 'Kbytes expanded memory installed.'
db 'or, if'
db 'Kbytes expanded memory available.'
db 'or, if'
db 'Kbytes assigned to cache.'
db 'or, if, 0'

emscache db 'EMSCACHE',0 ; logical device name for
; expanded memory manager

error db 'or, if'
db 'EMSCACHE installation error.'
db 'or, if, 0'
db 'program already resident.'
db 'or, if, 0'
db 'expanded memory manager not found.'
db 'or, if, 0'
db 'expanded memory not functional.'
db 'or, if, 0'
db 'expanded memory manager error.'
db 'or, if, 0'
db 'insufficient expanded memory pages available.'
db 'or, if, 0'
db 'expanded memory allocation failed.'
db 'or, if, 0'
db 'wrong expanded memory manager version.'
db 'or, if, 0'
db 'unable to initialize EMSCACHE pages.'
db 'or, if, 0'
db 'EMSCACHE: fatal mapping error.'
db 'or, if, 0'

apmap db 256 dup (0) ; app mapping context saved here
mymap db 256 dup (0) ; initial EMSCACHE mapping context

; The routine "intr" receives control whenever an application or the
; MS-DOS kernel issues a int 13h call to the ROM BIOS disk driver.
; int 13h requests for floppy disks, or for fixed disk operations
; other than simple reads (AH=1) or writes (AH=3) and simply passed
; on to the ROM BIOS without prejudice.

assume cs:TEXT,ds:NOTHING,es:NOTHING,si:NOTHING

intr proc far
cld
mov di,0000h ; physical fixed disk 0?
jnc intr1 ; no, skip it
cmp ah,3 ; read request?
je intr2 ; yes, process it
cmp ah,1 ; write request?
je intr2 ; yes, process it

intr1: jmp nld13h ; let ROM BIOS handle it
intr2: push ax ; save caller's registers
push bx
push cx
push dx
push si
push di
push bp
push de
push es
mov bp,sp ; set up stack frame

; equates to caller's registers
; saved in stack frame
reg00 equ [bp]
reg01 equ [bp+2]
reg02 equ [bp+4]
reg03 equ [bp+6]
reg04 equ [bp+8]
reg05 equ [bp+10]
reg06 equ [bp+12]
reg07 equ [bp+14]
reg08 equ [bp+16]
reg09 equ [bp+18]
reg0A equ [bp+20]
reg0B equ [bp+22]
reg0C equ [bp+24]
reg0D equ [bp+26]
reg0E equ [bp+28]
reg0F equ [bp+30]

mov ax,cs ; make our data addressable
mov dx,es
mov es,es ; safety first
cld

assume ds:TEXT,ds:TEXT,ds:TEXT,ds:TEXT

mov ax,0000h ; save caller's mapping context
mov si,offset mymap ; and initialize our context
mov di,offset apmap ; as cache index is accessible

intr endp

; Come here if catastrophic EMSC mapping error during int 13h service.
; Display message using ROM BIOS video driver then freeze system.

crash proc near
mov si,offset msg ; display message
mov msg ; "fatal mapping error"
jmp $ ; wait for Ctrl-Alt-Del

crash endp

; Carry out cached disk read operation. For single-sector reads,
; we either deliver the data from cache, or let ROM BIOS read the
; sector then make a copy for the cache. For multi-sector reads,
; which are much faster when passed to the controller as a unit,
; we only try to deliver from cache on a sector-by-sector basis
; if first sector of the group is already in the cache.

read proc near
push reg00 ; save original parameters
push reg01
push reg02
push reg03

mov ax,reg04 ; get number of sectors
and ax,0fffh
je read7 ; jump, zero sectors requested

call find ; find out if only sector in cache?
jnc read4 ; yes, do it sector by sector

call rombios ; possible multisector read
or ax,ah ; was read OK?
jnc read9 ; jump, read failed

read1: call find ; this sector in cache?
jnc read2 ; no, jump
call eselgn ; no, assign a slot
cld ; copy sector to cache

read2: dec sectors ; mount sectors
; jump if all sectors cached
call bump ; advance sector address
cmp lbytes,reg03 ; cache index > 3 pages?
jnc read1 ; no, index in limit
call read1 ; restore cache index
; continue with next sector

read3: call find ; this sector in cache?
jnc read5 ; no, jump

read4: call rcache ; copy from cache to caller
; go on next sector

read5: mov word ptr reg0A,0201h ; read 1 sector using ROM BIOS
call rombios ; successful read?
or ax,ah ; read error, give up
jnc read9 ; get a cache slot
call eselgn ; get sector into cache
cld ; count sectors transferred

read6: dec sectors ; jump, all done
jmp read7

```



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Power Programming

EMSCACHE.ASM

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```

call    bump                ; advance sector address
cmp     lbytes,bpp*3        ; cache index > 3 pages?
jne     read1               ; no, index is intact
call    read3               ; restore cache index
jmp     read3               ; continue with next sector

read1:  mov     byte ptr regah,8 ; return AH = 8 for success
        push    reg7ah       ; & clear caller's carry flag
        pop     reg7ah

read3:  pop     regds         ; restore original parameters
        pop     regcx         ; and return
        pop     regax
        ret

read    endp

; Carry out cached write operation. For safety's sake we always
; demand physical write from NON BIOS first, then update cache
; as appropriate.

write   proc    near
        push    regbx        ; save original parameters
        push    regcx
        push    regdx
        push    regsi
        push    regdi        ; save number of sectors
        call    rombios     ; call NON BIOS to write disk
        pop     ax           ; get back number of sectors
        and     ax,8ffh      ; zero requested?
        js      write9       ; yes, exit
        mov     sector,ax    ; save number transferred

write1:  call    find         ; find sector in cache?
        jc      write2       ; no, jump
        call    wcache       ; update data in cache

write2:  dec     sectors      ; count sectors
        js      write9       ; exit, all sectors checked
        call    bump         ; advance sector address
        cmp     lbytes,bpp*3 ; cache index > 3 pages?
        jne     write1       ; no, index is intact
        call    read3        ; restore cache index
        jmp     write1       ; continue with next sector

write9:  pop     regds        ; restore original parameters
        pop     regcx
        pop     regdx
        pop     regsi
        ret

write   endp

; Read sector from cache into caller's buffer.
; Call with: AX = cache slot
; Returns: nothing

rocache proc    near
        push    ds           ; map in cache sector
        call    mapsec      ; DS:SI = source address
        mov     si,ax        ; in EMS page frame
        mov     di,regbx     ; ES:DI = destination address
        mov     es,regds     ; in caller's buffer
        mov     cx,bps/2     ; length in words
        rep movsw            ; copy sector to caller
        pop     ds
        ret

rocache endp

; Write sector from caller's buffer into cache.
; Call with: AX = cache slot
; Returns: nothing

wcache proc    near
        push    ds           ; map in cache sector
        call    mapsec      ; ES:DI = destination address
        mov     di,ax        ; in cache
        mov     si,regbx     ; DS:SI = source address
        mov     ds,regds     ; in caller's buffer
        mov     cx,bps/2     ; length in words
        rep movsw            ; copy sector to cache
        pop     ds
        ret

wcache endp

; Search for matching cache index entry. Assumes that cache
; index pages are already mapped in. The index consists of
; 4-byte entries which are just the physical sector, head,
; cylinder, and drive for the associated cache position. The
; high bit of the drive byte is used as the "hit" bit since
; it is not needed to specify the drive. If an index position
; is all zero bytes, it has never been used (a sector number
; of zero never occurs).
; Call with: DS = segment TEXT
; Returns: ES = EMS page frame
;          (if match found)
;          Carry = false
;          AX = cache index slot number
;          (if no match found)
;          Carry = true
;          AX = undefined

find   proc    near
        mov     es,pframe    ; let ES:BX point to
        mov     bx,bx       ; base of cache index
        mov     ax,regcx     ; get caller's parameters
        mov     dx,regdx
        and     dx,8ff7fh    ; strip fixed-disk bit
        mov     cx,ishigh    ; get index highwater mark

find1:  cmp     ax,es:[bx]    ; compare sector, cylinder
        jnc     find3        ; find3

find2:  add     bx,4          ; advance through cache index
        cmp     bx,cx        ; reached end yet?
        jne     find1        ; no
        stc                 ; indicate no cache hit

find3:  mov     di,es:[bx+2]  ; strip hit bit
        and     cmp     di,dx ; compare drive, head
        jne     find2        ; jump, found match

        cr      byte ptr es:[bx+2],8bh ; set hit bit
        mov     ax,bx       ; return cache slot number
        shr     ax,1
        shr     ax,1
        cld                 ; indicate cache hit
        ret

find   endp

; Assign a cache slot for sector storage. Assumes that cache
; index pages are already mapped in.
; Call with: DS = segment TEXT
; Returns: AX = slot number
;          ES = EMS page frame

assign proc    near
        mov     bx,iptr      ; starting point for search
        mov     cx,regcx     ; caller's parameters
        mov     dx,regdx     ; identify sector
        and     dx,8ff7fh    ; strip the drive/hit bit
        mov     es,pframe    ; make page frame addressable

asn1:  test     byte ptr es:[bx+2],8bh ; hit hit off?
        js      asn2         ; yes, use this slot
        add     bx,4         ; look at next slot
        cmp     bx,lbytes    ; time to wrap?
        jne     asn1         ; not yet
        mov     bx,bx        ; wrap index pointer

asn2:  cmp     bx,iptr        ; back to where we started?
        jne     asn1         ; not yet
        mov     bx,bx        ; init. cache index pointer

asn3:  end      byte ptr es:[bx+2],7fh ; turn off all hit bits
        add     bx,4
        cmp     bx,lbytes    ; end of cache index?
        jne     asn3         ; not yet, loop
        mov     bx,iptr      ; start search over,
        jmp     asn1         ; guaranteed to succeed now

asn4:  mov     es:[bx],cx     ; found slot with hit bit off
        mov     es:[bx+2],dx ; put sector id stuff into it
        cmp     cx,ishigh    ; set highwater mark for find
        jnc     ishig,bx

asn5:  mov     ax,bx         ; return slot number
        shr     ax,1
        shr     ax,1

        add     bx,4         ; bump starting pointer
        cmp     bx,lbytes    ; not yet, loop
        jne     asn4
        xor     bx,bx        ; wrap if necessary

asn6:  mov     iptr,bx       ; save pointer for next time
        ret

assign endp

```

```

; Makes cache sector available by mapping in the appropriate
; EMS page and returning the offset of the sector within the page.
; We always use physical page 3 so we can avoid remapping index
; on multisector transfer if index is less than 4 pages long.
; Called with: AX = cache slot number
; Returns: AX = offset within EMS page frame

mapsec proc near
    mov     dx,0                ; divide cache slot number
    mov     cx,app              ; by sectors/EMS page to get
    div     cx                  ; AX = logical page
    push    dx                  ; DX = sector within page
    mov     bx,ax
    add     bx,ixpages          ; skip over index pages
    cmp     mappedj,bx          ; page already mapped?
    je      map1                ; yes, can skip mapping
    mov     mappedj,bx          ; save most recent mapping
    mov     ax,4403h
    mov     dx,handle
    int     67h                ; map in the EMS page
    or      eh,ah
    jnz     map2                ; jump if mapping error
    mov     cx,bps              ; relative sector *
    mul     cx                   ; bytes / sector =
    add     ex,(bpb*3)          ; offset in EMS page
    ret

map2: jmp     crash            ; unrecoverable mapping error

mapsec endp

; Restore mapping of logical page 3 to physical page 3. Only
; needed after a sector mapping if cache index requires 4 EMS
; pages (i.e. lbytes > bpb*3).
; Call with: Nothing
; Returns: EMS status in AH

rest3 proc near
    mov     ax,4403h            ; map physical page 3
    mov     bx,3                ; logical page 3
    mov     mappedj,bx
    mov     dx,handle
    int     67h
    or      eh,ah
    jnz     rest3a              ; check mapping status
    ret                          ; return, mapping was OK

rest3a: jmp     crash           ; unrecoverable mapping error

rest3 endp

; Request Int 13h function from ROM BIOS, using parameters
; from the stack frame.
; Call with: Nothing
; Returns: ROM BIOS status in AX
;          AX and carry flag also placed in caller's
;          registers on stack frame.

rombios proc near
    mov     ex,regAX            ; read/write, no. of sectors
    mov     bx,regBX            ; buffer offset
    mov     cx,regCX            ; sector, cylinder
    mov     dx,regDX            ; drive, head
    mov     es,regES            ; buffer segment
    pushf                                ; simulate software interrupt
    call    old13h              ; transfer to ROM BIOS
    pushf                                ; put away returned status
    regFLAG
    mov     regAX,ex
    ret

rombios endp

; Bump sector, head, and cylinder to next consecutive address.
; Call with: Nothing
; Returns: Nothing (values in stack frame altered)

bump proc near
    add     word ptr regES,bps/16 ; increment buffer address
    mov     cx,regCX            ; get sector, cylinder
    mov     dx,regDX            ; get head, drive
    inc     cl                   ; advance current sector
    mov     al,cl
    cmp     al,3fh
    jnz     jmp1
    mov     bx,1
    add     cl,60h
    add     cl,1
    mov     dx,0
    mov     dh,maxhead
    jmp     bump1

```

```

xor     dh,dh                  ; reset to first head
inc     ch                     ; increment cylinder
jnz     bump1                  ; jump if no carry needed
add     cl,40h                 ; carry cylinder high bits

bump1: mov     regCX,cx        ; put updated sector, head
        mov     regDX,dx        ; cylinder back to stack frame
        ret

bump endp

; Display message using ROM BIOS video driver (since DOS might
; not be in a stable state).
; Call with: DS:SI = address of ASCII string
; Returns: Nothing

msg proc near
    lodsb                       ; get next character
    or      al,0
    mov     es,0
    mov     bh,0
    mov     bl,7
    push    si
    int     10h
    pop     si
    jmp     msg

msg1: ret

msg endp

; Initialization routine, called at program load time. Returns
; address of 'init' label to MS-DOS as start of free memory, so
; that memory occupied by 'init' and its subroutines is reclaimed.

assume cs:TEXT,ds:TEXT,es:TEXT,si:TEXT

init proc near
    mov     cx,ex              ; is EMSCACHE already loaded?
    mov     ax,ex              ; use Int 13h vector to check
    mov     es,es:[(13h*4)+2] ; for EMSCACHE algo-co msg
    mov     si,offset ident
    mov     di,si
    mov     cx,offset ident1 - offset ident
    cld

reps cmpsb
    jnz     init1              ; not previously loaded, proceed
    mov     dx,offset msg1     ; EMSCACHE already present, exit
    jmp     init_err

init1: mov     ax,ex
        mov     es,es:[(67h*4)+2] ; use Int 67h vector to check
        mov     di,16           ; ES:DI = addr of device name field
        mov     si,offset esname ; DS:SI = expected ESM name
        mov     cx,8            ; length of device name field
        cld

reps cmpsb
    jz      init2              ; compare ESM name to driver header
    mov     dx,offset msg2     ; ESM is present, proceed
    jmp     init_err

init2: push    ds              ; restore ES = our data
        pop     es
        mov     ah,40h          ; test ESM status
        int     67h
        or      eh,ah
        jnz     init3
        mov     dx,offset msg3 ; driver is OK, proceed
        jmp     init_err

init3: mov     ah,46h          ; check ESM version
        int     67h
        or      eh,ah
        jz      init5
        mov     dx,offset msg4 ; general ESM error, exit
        jmp     init_err

init5: cmp     al,032h         ; deemed version 3.2 or later
        jee     init6
        mov     dx,offset msg7 ; version is OK, proceed
        jmp     init_err

init6: mov     ah,41h          ; get page frame segment
        int     67h
        or      ah,ah
        jnz     init4
        mov     bx,pframe,bx ; save segment of page frame

        mov     ah,42h          ; get number of available pages
        int     67h
        or      ah,ah
        jnz     init4
        mov     dx,offset msg8 ; jump if ESM error
        jmp     init_err

        mov     dx,offset msg9 ; save total ESM pages
        mov     ax,avail,bx
        jmp     init_err

```

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EMSCACHE.ASM

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```

        cmp     bx,4           ; must be at least 4 pages
        jae     init7          ; ok
        ds,offset msg5        ; insufficient pages, exit
        jmp     init_err

init7:   mov     bx,cmdtail     ; EMBAR - command tail
        call    acrq           ; get number of command
        cmp     ax,2           ; tail arguments
        mov     ex,availp      ; if no arguments, use cell
        jl      init9          ; available pages

        mov     ax,1           ; get address of command
        cell    acrq           ; tail argument #1 into ES:ax
        mov     si,bx
        cell    atoi           ; convert KB to binary

        mov     dx,ax          ; save copy of KB
        mov     cx,4           ; divide KB by 16 to get no.
        shr     ex,cx          ; of EMS pages to request
        and     dx,0fh         ; round up needed?
        js      init8          ; no
        inc     ax             ; yes

init8:   cmp     ex,availp      ; compare with pages available
        jne     init9          ; jump if ok
        mov     ex,availp      ; request too large, use available

init9:   cmp     ax,4           ; must own at least 64 KB
        jae     init10         ; (4 pages)
        mov     ax,4

init10:  cmp     ax,512         ; but we can't handle more
        jne     init11         ; than #152 KB (512 pages)
        mov     ax,512

init11:  mov     ownedp,ax       ; save total pages we will own
        mov     bx,ax
        mov     ah,43h         ; try end allocated EMH pages
        int     67h
        or      ah,ah
        js      init12         ; jump, allocation successful
        mov     dx,offset msg6 ; allocation failed, exit
        jmp     init_err

init12:  mov     handle,dx       ; save EMH handle

        mov     ax,ownedp      ; total pages / sectors/page
        xor     dx,dx
        mov     cx,app*4       ; / 4 bytes/index entry
        div     cx             ; = pages required for index
        or      dx,dx          ; any remainder?
        inc     ax             ; round up if necessary

init13:  mov     lxpages,ax      ; save pages in cache index

        mov     ax,ownedp      ; pages left for sector storage
        sub     ax,lxpages
        mov     cx,app*4       ; = 4 bytes/index entry
        mul     cx             ; = actual byte length of index
        mov     lxbtys,ax

        cell    format         ; format the RAMdisk
        jnc     init14         ; no formatting error, proceed
        mov     dx,offset msg8 ; formatting error, exit
        jmp     init_err

init14:  cell    signon         ; display program name etc.

        mov     es,es:[envptr] ; release our environment block
        mov     ab,49h
        int     21h

        mov     eh,0           ; get fixed disk characteristics
        mov     dl,09h         ; we'll only do physical drive 0
        int     13h
        end     cl,3fh
        mov     maxsac,cl       ; maximum sector number
        mov     maxhead,dh     ; maximum head number

        mov     ax,3513h        ; save previous contents
        int     21h
        mov     word ptr old13h,bx ; of ROM BIOS disk driver
        mov     word ptr old13h*2,es ; int 13h vector

        mov     dx,offset _TEXT;intr ; set int 13h vector to point
        mov     ax,2513h        ; to our own handler
        int     21h

        mov     dx,((offset init - offset entry)/16)*11h ; terminate and stay resident...
        mov     ax,3190h        ; exit with return code = 0
        int     21h            ; indicating success

init_err: dx             ; EMH initialization failed,
        mov     si,offset ermsg ; save specific error message
        cell    pmsg            ; display error heading
        mov     si
        cell    pmsg            ; display error description

        mov     ex,4c01b       ; exit with return code := 0
        int     21b            ; to indicate an error

init     endp

; Initialize cache storage. Zero out all allocated EMS pages,
; map the first four pages (which will be used for the cache
; index) into the page frame, and save that mapping context.

format   proc   near
        xor     bx,bx          ; initialize page counter
        mov     ax,pframe      ; make EMS page frame addressable
        jmp     fnt1

fnt1:    cmp     bx,ownedp      ; done with all EMS pages?
        jse     fnt2           ; yes, jump

        push    bx             ; save current page number
        mov     ex,4e09b       ; map to physical page 9
        mov     ds,bundle      ; get our EMS handle
        int     67b           ; request mapping by EMH
        pop     bx             ; restore page number
        or      bx,ah          ; if bad mapping give up
        jns     fnt3           ; (should never happen)

        xor     di,di          ; ES:DI = base of page
        mov     cx,bpp*2       ; page length (words)
        xor     ax,ax          ; fill page with zeros
        cld
        rep     stow

        inc     bx             ; increment page and loop
        jmp     fnt1

fnt2:    mov     ax,4e09b       ; pre-map all index pages
        mov     bx,bx
        mov     dx,handle      ; initialize logical page
        ; EMS handle

fnt3:    push    ax             ; some EMHs bash AL
        int     67b           ; map this index page into
        or      ax,ah          ; the page frame
        jmp     fnt3           ; jump if mapping failed
        inc     al             ; next physical page
        inc     bx             ; next logical page
        cmp     bx,4
        jnt3     fnt3

        mov     ax,4e09b       ; save initial mapping context
        push    dx
        pop     es
        mov     di,offset nymap
        int     67b
        or      ah,ah
        jns     fnt3           ; jump if context save failed

        cld
        ret

fnt4:    etc
        ret

format   endp

; Display program title, copyright notice, amounts of
; installed, available, and allocated expanded memory.

signon   proc   near
        mov     ax,totallp      ; total installed EMS pages
        mov     dx,16
        mul     dx             ; pages * 16 = KB
        mov     cx,10
        mov     si,offset ident1 ; offset to ASCII
        cell    itoe           ; convert KB to ASCII

        mov     ex,availp      ; available EMS pages
        mov     dx,16
        mul     dx             ; pages * 16 = KB
        mov     cx,10
        mov     si,offset ident2 ; offset to ASCII
        cell    itoe           ; convert KB to ASCII

        mov     ax,ownedp      ; EMS pages assigned to cache
        mov     dx,16
        mul     dx             ; pages * 16 = KB
        mov     cx,10
        mov     si,offset ident3 ; offset to ASCII
        cell    itoe           ; convert KB to ASCII

        mov     ax,offset ident ; display everything
        cell    pmsg           ; back to caller

signon   endp

        _TEXT
        end     antry

```



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Power Programming

into play. For example, the storage used by the cache must almost by definition be dramatically faster than the original storage medium. Almost invariably, therefore, the cache's storage medium will be dramatically more expensive, and economics will dictate that you'll never have as much as you'd like. It doesn't matter whether you are talking about caching disk sectors in

**The more frequently
a sector is
accessed, the more
likely that its hit
bit will be turned
on and stay on.**

RAM, caching inexpensive dynamic RAM in high-speed static RAM, or caching external memory in on-chip RAM (as in the case of the 80486 or i860)—the principles are the same: massive speed increases carry massive price tags.

Since the amount of cache storage will always be much smaller than the amount of main storage being cached, it will fill up—often quickly. Then what? You must have some procedure for deciding which data to kick out of the cache to make room for the new data. Your procedures for searching and updating the cache must be highly efficient. Otherwise, in the case of very large caches, the overhead of maintaining the cache will swamp out the advantage in access times, and you'll have a grouchy user on your hands. (Try setting `BUFFERS=99` on one of the original IBM PCs sometime to see what I mean.)

HOW EMSCACHE WORKS

Now let's see how EMSCACHE embodies the various programming issues I've mentioned above. When first installed, EMSCACHE verifies that an EMM is present and that the expanded memory subsystem is functional. It inspects the command line for a size parameter and allocates and initializes some expanded

memory. Next, it captures the interrupt 13h vector, which is the software interrupt invoked by the ROM BIOS floppy and fixed disk drivers. (By *captures* I mean that EMSCACHE saves the address of the previous owner of the interrupt vector, then places the address of its own handler into the vector.) Finally, EMSCACHE calls interrupt 21h function 31h to terminate and stay resident.

Subsequently, whenever DOS, one of its drivers, or an application program issues an interrupt 13h instruction to call the ROM BIOS disk driver, EMSCACHE will receive control. The cache program first determines the type of operation being requested. If the request is directed to a floppy disk or if it is not a simple sector read or write directed to a fixed disk, EMSCACHE simply passes the request on to the ROM BIOS and takes no further action. (I decided not to cache floppy disks in this illustration program because the logic needed to detect and handle disk changes would lengthen and complicate the program considerably for little gain in teaching value.)

If the request is for a read from the fixed disk, EMSCACHE first inspects its buffers to see if it already has a copy of the desired sector on hand. If so, the data is simply copied to the requester's buffer, and EMSCACHE returns directly to the caller. This is called a *cache hit*. If the sector is not in the cache, then EMSCACHE calls the ROM BIOS to carry out the physical read from disk and makes a copy of the sector for the cache before returning to the original caller.

If the request is for a write to the fixed disk, EMSCACHE again checks to see whether the sector is in the cache. If it is present, it compares the cache copy with the data whose address was passed in the write request. If they are identical, the write request was unnecessary and EMSCACHE returns directly to the caller. If the cache copy is different or if the sector is not in the cache, EMSCACHE calls the ROM BIOS to carry out the physical write operation, updates the cache, and returns to the caller.

When all of the cache memory is in use, and space for a new sector must be found, one of the sectors previously stored in the cache must be discarded. EMSCACHE uses a fairly simple-minded algorithm to pick the sector to discard. Each time there is a hit on a sector in the cache, a bit in the index entry for that sector is turned on. When EMSCACHE needs storage for a

new sector, it first sweeps through the index looking for any entries with that bit turned off and reuses those positions first. If the hit bits for all sectors are turned on, EMSCACHE turns them all off and then picks a sector to replace using a cyclic pointer.

Thus, the more frequently a sector is accessed, the more likely that its hit bit will be turned on and stay on. A sector that is read or written once and never accessed again will tend to be replaced in the cache in fairly short order. As long as you have a reasonable-sized cache—not too little and not too large—this primitive algorithm works well and it has the advantage of being pretty easy to understand. If you feel ambitious, you can replace this code with a more sophisticated cache-replacement algorithm. The best choice you could make would probably be a true least-recently-

EMSCACHE SOURCE CODE FILES

Code file	PC Magazine issue
ARGC.ASM	December 22, 1987
ARGV.ASM	December 22, 1987
ATOL.ASM	February 16, 1988
ITOA.ASM	February 29, 1988

Figure 3: These source files together with EMSCACHE.ASM build EMSCACHE.EXE.

used algorithm that maintains a time-stamp for the last access to each sector in the cache. You might also want to restructure the cache index into a binary tree or introduce a hash table.

BUILDING EMSCACHE

In order to build the executable file EMSCACHE.EXE, you'll need the source file EMSCACHE.ASM (see Figure 2) together with the following source files from previous PC Magazine issues (see Figure 3). Bring all these files together in the same directory, then issue the following sequence of commands, hitting the Enter key at the end of each line:

```
NASM EMSCACHE;  
NASM ATOL;  
NASM ITOA;  
NASM ARGC;  
NASM ARGV;  
LINK EMSCACHE+ATOL+ITOA+ARGV+AROC;
```

If you prefer, you can use a make file, such

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Power Programming

as that shown in Figure 4, to automate the task of building EMSCACHE.EXE.

USING EMSCACHE

To use EMSCACHE, just enter the command

```
EMSCACHE nnn
```

(You may find it convenient to put this command in your AUTOEXEC.BAT file.)

The command line *nnn* parameter is the number of kilobytes of expanded memory that you wish to allocate to the cache. If *nnn* is omitted or if it is larger than the



Figure 4: A suitable make file for EMSCACHE.EXE.

amount of expanded memory available, all of the free expanded memory (up to a maximum of 8,192K) will be used for the cache.

If EMSCACHE finds a copy of itself already present in memory, an error message will be displayed. Otherwise, it will terminate and stay resident, decreasing the amount of conventional memory available for the execution of other applications by *nnn*K, but improving the responsiveness of them all.

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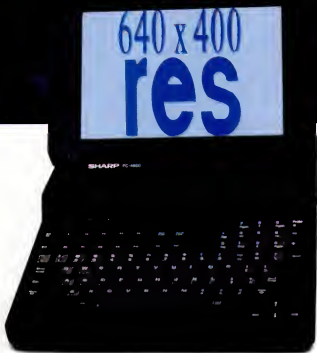
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Spreadsheet Clinic

FINDING YOUR PLACE

In the February 28, 1989, Spreadsheet Clinic, you printed a pair of macros that determine which part of a worksheet is visible on the screen and then return that portion of the worksheet to the screen at a later point in time.

Although this technique works, it really is more complex than it needs to be. To save the current position of a 1-2-3 worksheet, I use the macros shown in Figure 1. The first statement in the \s macro enters the absolute address of the current cell into the cell named CURRENT (B6). The next statement moves the cell pointer to the cell at the upper-left corner of the screen. The third statement in this macro enters the absolute address of that cell into the cell named CORNER (B8). The final statement in the \s macro calls the macro named \r. Since the statement in cell B2 shifts the worksheet, the macro is necessary to return the screen to its original appearance.

Dave Hilsee
Mobile, Alabama



These macros take a more streamlined approach to returning you to a prior worksheet screen, so let's take a closer look at how these commands work. The {BigRight}{BigLeft} combination in cell B2 moves the cell pointer horizontally into the column at the left edge of the screen. For example, if cells AG81..AN100 are visible on the screen, and the cell pointer is in cell AJ92, this combination would move the cell pointer to cell AG92.

The /wto/wth combination in cell B2 sets a horizontal title at the current row—in this case it would be row 92. Pressing the PgDn key at this point moves the cell pointer vertically to the row immediately below the bottom of the screen. In this particular example, 1-2-3 would move the cell pointer to cell AG101 and the cells AG81..AN91 and AG101..AN109 would then be visible on the screen.

Next, 1-2-3 clears the titles. Pressing the PgUp key at this point will move the

■ **FINDING YOUR PLACE:**
Simplifying the macro
that returns you to a prior
worksheet screen.

■ **STATIC SERIAL DATE**
VALUES: Entering the
current date as an
@DATE function.

cell pointer to the cell that was at the upper-left corner of the screen when the \s macro began. In our example, 1-2-3 would move the cell pointer to cell AG81. However, this cell will no longer be at the upper-left corner of the screen. Instead, note that cells AG70..AN89 will be visible on the screen. However, if you run the "return" macro (\r) at this point, it will restore the screen to its original appearance.

There were two typographical errors in the letter that Mr. Hilsee references. In cell B5 of Figure 1, there should have been a space between the t in Let and the L in LEFTCOLUMN. And in the formula (for cell B19) at the top of page 302, there should not be an @ symbol at the beginning of the range name LEFTCOLUMN.

STATIC SERIAL DATE VALUES

VP-Planner Plus's @TODAY function returns the serial date value of the current date. If you enter this function on February 28, 1989, it will return the value 32567; recalculate the worksheet on the following day and it will return the value 32568; and so forth.

To enter a "static" version of the current date rather than a "dynamic" one, I use the macro shown in Figure 2. Instead of entering the serial date value of the current date, this macro enters an @DATE function that returns that value. The first statement in the macro types this formula on the edit line:

```
=1989+@YEAR(@NOW)+100*@MONTH  
(@NOW)+@DAY(@NOW)
```

It then replaces it with its result: a six-digit value. The first two digits of this value will be the year, the next two digits will be the month, and the final two will be the day. Now, if VP-Planner Plus calculated this formula on February 28, 1989, it would return the value 890228.

The commands in the second cell convert the result of this formula into an @DATE function. To do this, VP-Planner Plus moves the cursor to the beginning of the value, types @DATE[, moves the cur-

RETURN MACRO			COMPLETE LISTING			
	A	B	C	D	E	F
1	\s	{Let	CURRENT,@CELLPOINTER("address")}			
2		/wto/wth{BigRight}{BigLeft}{PgDn}/wto{PgUp}				
3		{Let	CORNER,@CELLPOINTER("address")}			
4		{\r}				
5						
6	CURRENT					
7						
8	CORNER					
9						
10	\r	{Goto}IV\$192~{Goto}{CORNER}~{Goto}{CURRENT}~				
11						

Figure 1: These macros save the position of the worksheet relative to the screen and return that portion of the worksheet to the screen at a later point in time.

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VP-PLANNER PLUS MACRO					COMPLETE LISTING		
	A	B	C	D	E	F	G
1	\t	12000	=YEAR(@NOW)+100	=MONTH(@NOW)+@DAY(@NOW){Calc}			
2			{Home}@DATE({Right 2},{Right 2},{End})"				
3							

Figure 2: This macro for *VP-Planner Plus* enters an @DATE function that returns the serial date value of the date on which the macro was executed.

1-2-3 @DATE FUNCTION MACRO					COMPLETE LISTING		
	A	B	C	D	E	F	G
1	\t	12000	=YEAR(@CELLPOINTER("contents"))+100	=MONTH(@CELLPOINTER("contents"))+@DAY(@CELLPOINTER("contents")){Calc}			
2			{Home}@DATE({Right 2},{Right 2},{End})"				
3							

Figure 3: This 1-2-3 macro replaces an @TODAY function, an @NOW function, or a serial date value with an @DATE function that returns the same value.

sort two digits to the right, types a comma, moves the cursor two more digits to the right, types another comma, moves the cursor to the end of the entry, and types a closing parenthesis. Since the value 890228 was on the edit line before the *VP-Planner Plus* program executed these commands, the function

@DATE(89,02,28)

would be on the Edit line afterwards.

As soon as *VP-Planner Plus* composes the function, it enters it into the current cell. When it is locked into the worksheet, this function returns the same result as an @TODAY function would—the serial date value of the current date. However, unlike the result of the @TODAY function, the result of this function is static—it won't change when you recalculate the worksheet on successive days.

Patrick Sheppard
Vancouver, British Columbia
Canada

This technique is the simplest way we know of to "transform" an @TODAY function into an @DATE function. A 1-2-3 macro that replaces an existing @TODAY function, @NOW function, or serial date value with an @DATE function that returns the same value is shown in Figure 3. It should be invoked while the cell pointer is on the cell that contains the function or value you want to replace.

PC PRODUCTIVITY TIP

1-2-3 does not offer a command that allows you to preview a report on your screen before printing it. However, you can do this by issuing the /Print File command and specifying CON (the DOS device name for the screen of your computer) as the destination file. Then choose Go and the report will scroll across the screen.

CORRECTION

There was an error in the June 13, 1989, *Spreadsheet Clinic* on page 365. The code line you would enter when using 1254:3725 (the address of the first byte in the CGA sequence) is

h 3725 3

Further, to determine the address of the last color-controlling byte, you would enter the following:

h address 9

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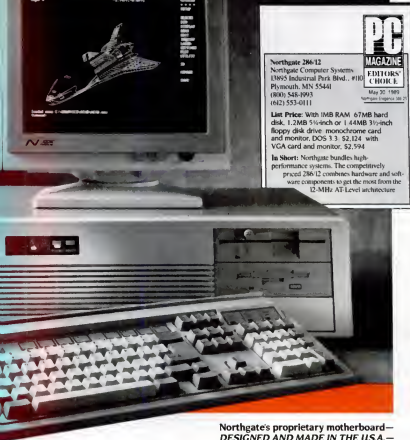
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EDITORS' CHOICE

May 30, 1989
Northgate (page 38-7)

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CIRCLE 351 ON READER SERVICE CARD

by
Neil J. Rubenking

User-to-User

FAST AUTOEXECs

In *User-to-User* in the October 31, 1988, issue, you published a letter by Bill Cooper that states how the boot process could be made faster by splitting AUTOEXEC.BAT into two halves and running the second half from a RAMdisk. There is a much more elegant way to do this—just insert the following five lines at the beginning of your AUTOEXEC.BAT file:

```
IF EXIST E:\AUTOEXEC.BAT
GOTO Continue
COPY AUTOEXEC.BAT E:
E:\AUTOEXEC
:Continue
```

The above technique can be adapted very easily to the case where you have more than one hard disk and do not know for sure which drive is the RAMdisk, as follows:

```
IF EXIST %1:\AUTOEXEC.BAT
GOTO Continue
COPY AUTOEXEC.BAT E:
IF EXIST E:\AUTOEXEC.BAT
E:\AUTOEXEC E
COPY AUTOEXEC.BAT D:
IF EXIST D:\AUTOEXEC.BAT
D:\AUTOEXEC D
COPY AUTOEXEC.BAT C:
IF EXIST C:\AUTOEXEC.BAT
C:\AUTOEXEC C
:Continue
```

This way you even get the letter of the RAMdisk in parameter %1, which also may be useful for other setup tasks.

Hans Salviusberg
Berne, Switzerland

PC Since every file on your disk will use at least one full cluster (usually from 1K to 4K), it's really worthwhile to use one file instead of two. For a system in which the RAMdisk drive is known, the first method—with the RAMdisk letter "hard coded"—is the best way to go.

If you do use the second method, there

■ **FAST AUTOEXECs:**
Execute your AUTOEXEC
from a RAMdisk without
creating an extra file.

■ **XCOPY BY DATE:** Use
XCOPY to copy files into
directories selected by
date.

■ **MULTIPLE DOS PROMPT
COMMANDS:** Use FOR to
run multiple commands
from the DOS prompt.

are some things to be aware of. First, you might think to beautify the batch file output by redirecting the output of the COPY commands to NUL. That won't work—the "Invalid drive specification" message shows on the screen regardless. The reason for this is that DOS error messages are sent to the Standard Error Device, and thus cannot be redirected. Second, this technique assumes that, if a RAMdisk exists, it will be the highest drive letter. This assumption is usually correct, but it is not a certainty. Third, if you use the SUBST command to assign drive letters to subdirectories, you may run into some minor problems.

Suppose, for example, that you don't have an E: drive but the latter part of your AUTOEXEC file uses the SUBST command to make E: refer to a certain directory. There's no problem during boot-up because the SUBST assignment hasn't happened yet. The batch file doesn't find E:, so it goes on to look for the D: and C: drives. But if you happen to run AUTOEXEC.BAT from the command line after the SUBST has taken place, it will try to copy itself to whatever directory you've defined as E:, and you will end up with an unexpected copy of AUTOEXEC in that directory. This isn't really a big problem, but it is somewhat inelegant.

XCOPY BY DATE

The secretaries in my office recently reached a milestone. They managed to create so many documents in a single directory (over 1,200 files) that the word processing package they use began to choke and lock up every time they tried to load a document. Apparently no one had ever taught them about subdirectories.

The first thing I did was to copy documents to subdirectories based on their common extensions. This still left over 500 files in one subdirectory, so I decided to break this subdirectory down further by dividing it into subdirectories based on the file-creation date.

I tackled the problem by writing a batch program (see Figure 1) to separate the files. I had been exploring the XCOPY command to set up incremental backups, and I realized that I could use its /D and /M switches to do this job for me. The /D switch is used to copy only files that have been changed since a specific date; the /M switch copies only files with the archive bit set on, then turns the bit off in the original. The finishing touches to the batch program were to use ATTRIB to set the archive bit on for all the document files and to use MD to create the subdirectories.

The key to this batch file working properly is to start at December and work backward, with the archive bit being turned off once a file is copied. In this way, a file is copied only once. Otherwise the NOV directory would have DEC and NOV files, OCT would have DEC, NOV, and OCT, and so on. I could generalize the batch file by using parameter variable %1 for the file extension and %2 for the year. This could be done by globally replacing DOC with %1 and 1988 with %2 and then entering D:\COPY DOC 1988 at the DOS prompt.

Finally, I deleted the source files and then ran a defragger to clean and speed things up. Now the word processing package works fine, the secretaries can load their files, and the disk I/O is much faster.

Gary M. Lee
Centerville, Ohio

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User-to-User

PC The key to this system is the /M switch for XCOPY, which copies any file whose archive bit is set on and then turns that bit off. It can make the archive bit function as a flag to indicate which files haven't been copied yet. You can use this switch to copy (or back up) one hard disk directory onto multiple floppy disks, as well. Just use the ATTRIB command to set the archive bit on all the files you want copied, and then enter XCOPY C:\FULL\PATH*.* A: /M. XCOPY will copy as many files as it can, turning off the archive bits as it goes, then fail with a "Disk full" error. Put another floppy in A: and repeat the process until all the files have been copied.

Of course, in a more general sense you won't necessarily want to start with December. If you run this batch file in April, you'll make April the first entry and work backward from that point. It would be difficult to make a batch file like this that would automatically start with the current month.

MULTIPLE DOS PROMPT COMMANDS

A real timesaver is the almost-forgotten internal DOS command FOR. Suppose you need to copy the following five files from a hard disk to a floppy: BPACCESS.DBF, BPLEVEL.DBF, BPACCESS.DBT, BPAREA.DBF, and BPTTEST.DBF. Also suppose that the command DIR BP*.DB? lists 40 files, only 5 of which are the ones you want. One way to make the copies is to create four separate COPY commands. But instead of creating the COPY commands, we can let DOS do the work by issuing the following command at the DOS prompt:

```
FOR %F IN (ACCESS LEVEL AREA TEST)
DO COPY BP%F.DB? A:
```

Another case where FOR is handy occurs when copying from one subdirectory to another only files with certain extensions (for example, .DBF, .DBT, .FRM, and .EXE). This can be accomplished with the following command:

```
FOR %F IN (.DB? .FRM .EXE) DO COPY *.%F
\SUBDIR
```

DCOPY.BAT	COMPLETE LISTING
REM This batch file is used to move .DOC files from the main word processing directory to sub-directories named JAN - DEC. It should be called from the main word processing directory. After checking to see that everything copied correctly the source files should be deleted manually.	
ECHO OFF	
ATTRIB +A *.DOC	
MD JAN	
MD FEB	
MD MAR	
MD APR	
MD MAY	
MD JUN	
MD JUL	
MD AUG	
MD SEP	
MD OCT	
MD NOV	
MD DEC	
XCOPY *.DOC \DEC /D:12-01-1988 /M	
XCOPY *.DOC \NOV /D:11-01-1988 /M	
XCOPY *.DOC \OCT /D:10-01-1988 /M	
XCOPY *.DOC \SEP /D:09-01-1988 /M	
XCOPY *.DOC \AUG /D:08-01-1988 /M	
XCOPY *.DOC \JUL /D:07-01-1988 /M	
XCOPY *.DOC \JUN /D:06-01-1988 /M	
XCOPY *.DOC \MAY /D:05-01-1988 /M	
XCOPY *.DOC \APR /D:04-01-1988 /M	
XCOPY *.DOC \MAR /D:03-01-1988 /M	
XCOPY *.DOC \FEB /D:02-01-1988 /M	
XCOPY *.DOC \JAN /D:01-01-1988 /M	
ECHO ON	

Figure 1: This batch file uses XCOPY to put each month's DOC files into a separate directory.

User-to-User

Consider as well the case in which you need to create multiple subdirectories. I recently needed to create ten subdirectories representing ten states. The following does just this:

```
FOR %A IN (VA NC SC GA FL AL TN WV  
MD PA) DO MD \USA\%A
```

Here is a way to set the date and time, change directories, and load a program:

```
FOR %A IN (DATE TIME CD\DIR EXECNAME)  
DO %A
```

Have you ever wanted to use the TYPE command on multiple files (TYPE *.TXT >>TEXT)? You can't because the TYPE command does not accept wildcards. But if you use a wildcard inside the parentheses of a FOR command, it works just fine:

```
FOR %A IN (*.TXT) DO TYPE %A >>TEXT
```

The above command creates and exe-

cutes a separate command for each find of the wildcard.

Remember, anytime you need multiple commands of the same type, check the FOR command first.

John William Beckner
Lumberton, North Carolina

PC Regular readers of this column know that we exploit the FOR command as much as possible in batch files. Using FOR to execute one batch line that handles ten operations is much faster than executing ten separate batch lines. However, FOR is indeed just as useful at the DOS command line. It certainly won't replace batch files, but you can use it to execute a series of commands, provided that each command is a single word with no command-line parameters.

You can get into trouble if you use redirection in a FOR command. DOS sets up the redirection only once, before executing any part of the FOR command. For example, this will *not* work:

```
FOR %F IN (X1 X2 X3) DO MORE < %F
```

DOS looks for a file called "%F", doesn't

find it, and ends the command with a "File not found" message.

The lesson here is a simple one—don't use the FOR variable in filenames for redirection.

PC **PRODUCTIVITY TIP** The PAUSE command in a batch file always displays the line "Strike a key when ready . . ." You can suppress this message and substitute one of your own. Just ECHO your message and redirect the output of PAUSE to the NUL device. For example,

```
PAUSE > NUL
```

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edited by
Craig L. Stark

Power User

FIXING A BUG

David Bartholomew's letter (Power User, December 13, 1988) says that when *dBASE III Plus* databases are linked with the SET RELATION TO command, the DELETED() status of the secondary database is ignored even if SET DELETED is ON.

I have found a way to persuade *dBASE III Plus* (and *FoxBASE Plus*) to pass over deleted but unpacked records in a related database. In Mr. Bartholomew's example, the related database is indexed on the customer number field via this command:

```
INDEX ON CUSTOMER TO CUST
```

The problem arises because this index includes pointers both to deleted and to undeleted records. This is necessary because you might decide to RECALL a record at any moment. The consequence, however, is that wrong information can be pulled up if the index happens to point to a deleted (and obsolete) lookup record.

My solution is to build a conditional index in which deleted records are assigned a "garbage" string that will definitely not match. For example,

```
INDEX ON IIF(DELETE(), "SE", CUSTOMER) TO  
CUST
```

Unfortunately, this solution does employ the "immediate if" function, which is not available to pre-*dBASE III Plus* users.

Jonathon Cerf

New York, New York



The INDEX command is much more versatile than many people realize. The index key can include constants, memory variables, functions, or fields from related databases (see Power User, March 28, 1989). In fact, you can build an index on any valid data expression.

The danger with these exotic indexes is that they are difficult to update, particularly if the key expression used contains a memory variable or other expression that

■ **FIXING A BUG:** When linking databases, there's a workaround for the bug in *dBASE III Plus* and *FoxBASE Plus*.

■ **WORDPERFECT'S /R SWITCH:** The /R switch has a different function in *WordPerfect 5.0*.

■ **AUTOMATICALLY INSERT A TABLE OF CONTENTS:** Insert table of contents codes in a *WordPerfect* document while typing.

■ **COUNTING PAGES IN WORD:** Retrieve a page count in *Microsoft Word 4.0* and insert it into your header or text.

is external to the actual fields being indexed. Thus, if a memory variable is used but is not present the next time the index is accessed, the system will choke.

Note, then, that the index file created in Mr. Cerf's workaround is *not* automatically updated when an item is deleted or recalled. Consequently, it is advisable to create such indexes immediately before their use and to erase them immediately after. —Brad Stark

WORDPERFECT'S /R SWITCH

In the September 13, 1988, issue one of your Productivity Tips recommends using the /R option in *WordPerfect* to load the complete program into memory. Users should be aware that in *WordPerfect* Version 5.0 there has been a change in how this option functions. Rather than load the program overlays into conventional memory, as earlier versions of *WordPerfect* did, *WordPerfect* 5.0 uses this switch to load

them into expanded memory.

The manual states that you need about 300K of expanded memory to use the /R function, but I've found through trial and error that you need 328K (327,680 bytes to be exact). If you do not have expanded memory or have less than 328K of unallocated expanded memory, *WordPerfect* 5.0 will return an error message and then load and run as if you had not used that function.

Steven M. Atran
Tallahassee, Florida



I hope nobody was seriously confused by this difference in *WordPerfect* 5.0. Normally either version of *WordPerfect* loads only a portion of its program code into RAM. When it needs to use a feature and the code for that feature isn't present in RAM, it loads it from the disk. This can slow down your operations. In Version 4.2 the /R option causes the normally overlaid code to be loaded into ordinary RAM. In Version 5.0, /R makes *WordPerfect* store that code in expanded memory. Either way, you avoid unnecessary disk accesses, but the 5.0 method leaves more ordinary RAM free to hold your documents. —Neil J. Rubenking

AUTOMATICALLY INSERT A TABLE OF CONTENTS

WordPerfect makes no provision for inserting table of contents codes during the initial typing of a document. This leads to excessive efforts later to scroll through the document and insert the codes at the paragraph numbers and titles.

Setting up a *WordPerfect* document for a table of contents can be time-consuming, particularly for large technical documents that frequently contain dozens of paragraph numbers and titles. The normal *WordPerfect* procedure calls for scrolling through the completed document and identifying each title that is to be listed in the table of contents. This requires blocking each heading, pressing Alt-F5 (mark text), selecting Table of Contents, and choosing a level. However, using the macro I've en-

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closed, you can mark each such paragraph during the initial typing of the document.

K. Karl Kuller
Sterling, Virginia



The macro Mr. Kuller submitted involved storing a copy of table of contents codes for each level in a separate file, bringing that file into Document 2, and copying the codes out as needed. Fortunately, there's no real need to use a separate file or to squander Document 2 on this operation. The simple macro in Figure 1 will insert a begin-end pair of codes for Table of Contents level 1, and that may be all you need.

If you want to be able to choose the Table of Contents level, you'll need to modify Figure 1 in the macro editor. After creating the macro above, press Ctrl-F10 and then Alt-T. You'll get a choice: replace the existing macro or edit it. Choose 2 to select edit and, while you're in the editor, choose 2 again (Action).

In the macro editor, press Enter to create a blank first line. Now press Ctrl-PgUp and select CHAR from the menu of special macro commands. Finish the line with

```
"Select ToC level (1-5); "
```

This prints the message on your screen be-

tween the two tilde (~) characters, waits for the user to press a key, and stores the key in variable 1. Now move your cursor to the second 1 after {MARK}. Delete it, and insert a {VAR 1} code by pressing Ctrl-V followed by Alt-1.

This looks good, but if you press a key other than a number from 1 to 5, it will fail. So we'll add error checking. Move up to the second line and hit Enter three times. On the first line you've just opened up, insert a {CASE} code by selecting it from the macro codes menu. Insert a {VAR 1} code, and finish out the line:

```
{CASE} {VAR 1} 1"OK"2"OK"3"OK"4  
"OK"5"OK"
```

This will cause WordPerfect to jump to a label called OK if the value of {VAR 1} is 1, 2, 3, 4, or 5. On the next line, enter a {RETURN} code by selecting it from the macro codes menu. This has nothing to do with the Return key—it's a command that causes the macro to end. On the next line insert a {LABEL} code, again from the macro menu, and finish the line with OK.

When you're done, the macro should look like Figure 2. Press F7 twice to save the macro and leave the editor.

Now Alt-T prompts you for the Table of Contents level. If you type a number from 1 to 5, you'll get a begin-end pair of codes for that level, ready for you to type in the heading. If you type any other key, nothing will happen.—Neil J. Rubenking

ALT-T MACRO	COMPLETE LISTING
<Ctrl-F10>	Begin macro definition
<Alt-T>	Call it Alt-T for Table of Contents
<space>	Insert a space
<Alt-F4>	Block on
<Left><Left>	Block the space
<Alt-F5>11	ToC level 1
	Delete the space
<Ctrl-F10>	End macro definition

Figure 1: This macro inserts a begin-end pair of codes for Table of Contents level 1 in WordPerfect.

MODIFIED ALT-T MACRO	COMPLETE LISTING
{CHAR}1"Select ToC level (1-5); "	
{CASE} {VAR 1} 1"OK"2"OK"3"OK"4"OK"5"OK"	
{RETURN}	
{LABEL}OK	
{DISPLAY OFF}·{Block}{Left}{Left}{Mark Text}1{VAR 1}{Del}	

Figure 2: By editing the macro shown in Figure 1, you can choose the Table of Contents level.

Power User

COUNTING PAGES IN WORD

It's often necessary to enter the page count of a document into your text. The macro shown in Figure 3 will handle this chore automatically.

First, create a glossary entry called *Mark* designating any single character that you never use. For example, you could choose an asterisk or backslash, though for most people the best option is one of the high-order ASCII characters. *Word* will let you create these by holding down the Alt key, typing a number such as 245 on the numeric keypad, and then releasing the Alt key. The macro requires that the document pagination is up to date (use the Esc Print Repaginate command). This is best done

These lines display a reminder to the user and start a manual repagination of the document. The first pause command forces the macro to stop so you can read the message. The second pause command lets you manually paginate. If you leave it out, the macro will ignore the request for manual repagination.

Another useful modification of Mr. Ryder's macro is to nest this macro inside another one. The most likely place to use this macro is in a header. For example, type the following line:

Page x of y pages

Now, you should name this macro *Pages* and combine it with the built-in *Page* macro by nesting both inside a third macro called *Headerpage*. (The *Page* macro automatically enters the current page of a docu-

PAGES MACRO

COMPLETE LISTING

```
<ctrl esc><esc>mark<f3><left>=set M=selection>
<ctrl pgdn><ctrl esc><alt f5>=set P=field>
<esc>P<f7><del>
<esc>M<tab>u<tab>y<tab>n<enter>
<ins><right><backspace>
```

Figure 3: This macro automatically enters the number of the last page of a file at the cursor position.

manually, so it is not included in the macro.

First, the macro enters the placemark *Mark* at the current cursor position and records it in a variable called *M*. Next, it goes to the end of the document, invokes the *Jump Page* command (which uses the current page as the default entry), and sets the variable *P* to the current page number. Then the macro deletes the variable *P* to the scrap, searches for the marker, and inserts the page number at that location. Finally, it deletes the marker, leaving the total page count in the scrap so you still have it available to insert elsewhere.

Alan Ryder

Winterthur, Switzerland

PC This is a useful macro as it stands. However, there is a way to add the *paginate* command to the macro and still *paginate* manually. Simply add the following lines after entering the placemark, but before going to the end of the document:

```
<Pause Macro will now repaginate.
Hit enter to start and when
pagination is done>
<ctrl esc>pr<enter>=>=pause>
```

ment). The *Headerpage* macro will now look like this:

Page page<f3> of page<f3> pages

Run it while creating a header, and you will get

Page (page) of XX pages

The (page) statement will automatically update at print time. To update the total number of pages, you will need to rerun the *Pages* macro before each printing.—M. David Stone

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Languages

HUGE QUICKBASIC ARRAYS

I purchased Microsoft's QuickBASIC 4.0 because it is supposed to be able to handle data arrays as large as available memory. Unfortunately, whenever I attempted to dimension a fixed-length string array larger than 128K (my application requires at least 2,000 fixed-length strings of length 80), I would receive an error message.

According to the QuickBASIC documentation, creating an array larger than 64K requires using the `$DYNAMIC` meta-command and the `/AH` compile switch. I tried this but it didn't help. Even though BASIC's `FRE(-1)` function showed that more than 300K of memory was available, I still received a "Subscript out of range" error.

The solution to this problem was both interesting and informative. As it turned out, because the length of each string in my array was not an even power of 2, the last string that fit within a 64K segment did not end exactly on (did not align on) a segment boundary. QuickBASIC can handle only one "intersegment gap" in a given array, which limits the array to a total size of 128K.

The answer, therefore, is to make each element an even power of 2 in length. In my case, though I needed only 80 bytes per element, I had to increase it to 128 bytes.

James J. Orloff

Rochester, Minnesota

PC Because numeric variables always have a length that is a power of 2, the only limit QuickBASIC will impose is a maximum of 32,767 elements. But fixed-length and `TYPE` arrays are another matter entirely. Because QuickBASIC will not allow an array element to span a segment boundary, it will, in fact, "fudge" the address of the first element to whatever is needed to ensure that the last element in the first segment ends on a segment boundary.

A numeric array always begins at offset zero, in whatever segment QuickBASIC happens to place it. But when you dimension a fixed-length string array to 820 or more elements and each element has a

■ **HUGE QUICKBASIC ARRAYS:** Tips for creating huge arrays in QuickBASIC that occupy all available memory.

■ **CAREFUL USE OF INITIALIZATION CODE:** Initialization code is handy in Units, but misusing it can defeat Turbo Pascal's "smart linking."

■ **RUN MULTIPLE COMMANDS:** Use this C program to run multiple commands from the command line without having to write a batch file.

■ **SELF-MODIFYING TURBO C PROGRAMS:** Use Borland Turbo C .COM files to modify themselves and store program data within the executable file.

length of 80 characters, QuickBASIC will instead assign the first element to begin at address 16. However, a split is still inevitable by the end of the second segment, which is why QuickBASIC refuses to create a fixed-length array larger than two 64K segments.—Ethan Winer

CAREFUL USE OF INITIALIZATION CODE

While using the Turbo Pascal 5 integrated debugger, I discovered a mistake that is probably common for users of Turbo Pascal Versions 4 and 5. Most users build up a personal utility Unit to provide all those standard facilities that Borland "forgot" to include. Turbo Pascal's smart linking pre-

vents code from being included for parts of the Unit that are not called for in the program. Well, this is almost true.

Single-stepping through a new program, I found myself in unfamiliar territory. Then I recognized it as the initialization code for a seldom-used printer procedure in my personal utility Unit. Initialization code (the code between the final `BEGIN..END` pair in the Unit) is always included, whether or not the variables initialized are ever used. Each program I've written over the last year contained machine code assigning a default page length of 66 and an initial line count of 1, even if the program never printed a single character in page format.

To keep executable programs at minimum length, therefore, avoid initialization in general-purpose Units. I have moved my print utility to its own Unit that must be specifically invoked in the "uses" clause.

John P. Reid

Beer, Delaware

PC Code in the Initialization section of a Unit not only gets included in every program that uses that Unit, it always gets executed. The Initialization area is intended for code that's essential to the working of the Unit. For example, you might put a keyboard Interrupt Service Routine (ISR) in a Unit, and in the Initialization area put the commands to install the ISR. For completeness, you'd add an Exit Procedure to DE-install the ISR. Now incorporating that ISR into a program is as simple as putting the Unit in your "Uses" clause.

That's one kind of example—a single-purpose Unit. But for Units that contain a multitude of different routines, it's a different story. Turbo Pascal's "smart linking" means that any routines your particular program doesn't call won't take up space in the compiled program. But, initialization code is always included. Not only that, any routine that's called by the Initialization code will be included in the compiled program. If you create a general-purpose Unit, don't put any code between

Languages



This is a great utility! I liked Mr. Callender's program so much that I took it a few steps further.

First, I increased the command stack from an internal two-dimensional array to an array of pointers that are allocated on-the-fly. I also increased the array size so it allows the program to run up to 100 commands. And I renamed the program, which is shown in Figure 1, to RUN.

The original program prompted you for each command: you typed each command and pressed Return. If you pressed Return by itself, the program began to execute the commands. I retained this, but added a facility to pass several commands on the command line. Of course you must use delimiters to separate the commands. The program is set up to accept semicolons to separate them, but if you prefer a different delimiter, you can change the SEMICOLON define at the beginning of the source code.

Programs that execute other programs or commands always face the dilemma of

distinguishing between DOS commands, programs, and .BAT files. RUN uses a table of internal DOS commands to distinguish them from external commands or batch files. If it finds a command in the table, it uses the system function to load the DOS command processor, COMMAND.COM, and run the command. If it's not in the table, RUN passes the command to the spawnvp library function, which will try to run the command as a program. If spawnvp returns an error, RUN will assume that the program was, after all, a .BAT file and passes it to COMMAND.COM to execute.

To use RUN, type

```
RUN command1; command2; command3;  
... <enter>
```

If you simply type

```
RUN
```

the program will prompt you for each command. If you press Return by itself after one of the prompts, RUN will begin to execute the commands in order.—Richard Hale Shaw

SELF-MODIFYING TURBO C PROGRAMS

I needed to write a program that could save the system date and time every time I ran it. Instead of creating an external data file to store this information, I used Turbo C's Tiny memory model to create a .COM file so that the program could modify itself. The program updates the date and time variables in their locations in the executable program on the disk.

Tom Cervenka
Berwyn, Illinois



This is an inventive solution to a common problem. Suppose you wanted to write a program that needs to maintain and update a small amount of information—date and time is a perfect example. You can choose the usual solution and create an external data file, but then you have to answer several questions. What will you name the file? Where will you store it? Should you write-protect the file to prevent accidental deletion? What if the program can't find the file?

You won't even need to consider these questions if you use the WRITEVAR function shown in Figure 2. The function

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allows the calling program to store data inside of itself. To use the function you must create a .COM file using Turbo C's Tiny memory model. The only caveat is that the combined program and data space used by a .COM file must not exceed 64K. However, most of the time this should be more than enough space for the smaller utilities that would use this technique.

WRITEVAR takes three parameters. The first is the name of the executable program, which under DOS 3.0 and later is always available in C as argv[0]. The next parameter is the address of the variable. The variable is defined as a void pointer in the function prototype, allowing the calling function to pass WRITEVAR the ad-

dress of any type of object. The last argument is the size of the variable itself.

WRITEVAR's job is straightforward: it opens the file, seeks to the variable's offset in the executable program file, writes the new contents of the variable, and closes the file. The most critical step in the process is calculating the offset of the variable that's in the file. Since Turbo C's Tiny model produces a .COM file, this is easy. When DOS loads the file from disk, it creates the Program Segment Prefix (PSP) and places the contents of the .COM file immediately above it in memory. By subtracting the size of the PSP (256 bytes) from the address of a variable, we can obtain the disk offset of the variable in the .COM file.

To calculate this offset, WRITEVAR takes the address of the variable (which is passed as a void pointer), and assigns it to

an unsigned local variable. It decrements the variable by 100h (256 bytes) and uses this value as the offset into the executable file. The varlen parameter ensures that the appropriate number of bytes is written at that offset. The function returns 1 if the variable was successfully updated.

The function can work with a sizable amount of data. Let's say that your program's code was around 32K. Assuming that the program required about 6K of stack space and about 8K for other globals (which is quite a lot), you'd still have near-

The most critical step in the process is the calculation of the offset of the variable that's in the file.

Since Turbo C's Tiny model produces a .COM file, this is easy.

ly 18K left over for the data to be updated from time to time. A pop-up notepad program could use this technique to store a few pages of notes inside itself.

To demonstrate the use of the function, I wrote a simple main that displays the contents of a character array (you can use any type of object—char, int, long, structure, array, etc.). The program asks the user for new data to store in the array, and after getting it, calls WRITEVAR. Note that the program takes steps to ensure that the new data does not exceed the length of the storage space, including a NUL terminator. —Richard Hale Shaw

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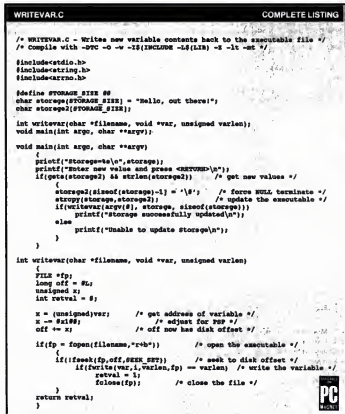


Figure 2: The WRITEVAR function shown here updates variables in a Turbo C .COM file, eliminating the need for some types of external data files.

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Tutor

GETTING A HANDLE ON THE DOS ENVIRONMENT

Recently, I began to run into the DOS error message "Out of environment space" every time I tried to load a program by way of a batch file. Taking the advice of a technical support person, I inserted the line

```
Replace with Insert 0(15)--line
```

into my CONFIG.SYS file. This seemed to solve my problem, but I don't know how or why or whether I need to take further action.

What is the relationship between the "Out of environment space" message and the line I added to my CONFIG.SYS? I'm using a Compaq Deskpro 386/20 and an Everex 12-MHz 286.

Norm Ringel
Columbia, Maryland



You've stumbled over one of DOS's most under-used but fun features—the environment. The DOS environment is underused because you usually don't have to tamper with it in order to get your job done. But now that you've discovered it, you'll be glad to know that tinkering with your environment can be a worthwhile way to tailor and fine-tune your system.

The term *environment* is often used to mean the current state of a given system. But in the language of DOS itself, it refers specifically to a small area of memory that DOS uses to hold variables and their values. You specify some of these environment variables when you put a PATH, PROMPT, or APPEND command into your AUTOEXEC.BAT file.

When the environment is no longer large enough to hold all of the variables specified, you get the "Out of environment space" message. The /E switch in the SHELL command that you specified simply tells DOS to enlarge the environment from its default to the number of bytes specified—in your case, 320. The default size is 128 bytes for DOS 3.1 and earlier, 160 bytes for DOS 3.2 and later.

■ **GETTING A HANDLE ON THE DOS ENVIRONMENT:** Learn to make good use of a little-understood feature of DOS.

■ **FAST COMMAND.COM RELOADS:** Use a RAMdisk to decrease the amount of time it takes to reload COMMAND.COM.

■ **CHANGE QUICKLY TO 43-LINE MODE:** Here's a DEBUG script to change your EGA display from standard 25-line mode to 43-line mode.

Versions 3.0 and earlier of DOS don't recognize the /E switch—one of many good reasons to upgrade—and, in Versions 3.1 and 3.2, the feature is undocumented. Also, the format is slightly different in Version 3.1: instead of setting /E equal to the number of bytes, you set it equal to a number of 16-byte paragraphs. Allowable values range from 11 to 62. In Versions 3.2 and later, the allowable range is 160 to 32,767 (the actual size must be a multiple of 16, but DOS will adjust it for you).

The /P switch in the SHELL statement simply tells DOS to load COMMAND.COM and AUTOEXEC.BAT and to keep COMMAND.COM permanent: this switch should always be used unless you know you have a good reason to do otherwise.

Before we move on, we should clarify one point for the purists in the crowd: the SHELL command itself actually has no switches. The several switches that may be used in conjunction with the SHELL command, including /E and /P, belong to COMMAND.COM, not SHELL.

How big should your environment be? That depends on to what extent you and your applications use the environment, but more on that in a minute. The easy answer is that it's big enough as long as you're not a victim of the "Out of environment space" error. For many people, the default is just fine. Lest you be tempted to give your environment the full 32K-plus bytes, remember that every byte you allocate to the environment takes a byte away from RAM your applications can use. You're better off enlarging your environment when it becomes a problem.

Now for the fun. Being the sensitive and caring operating system that it is, DOS allows you and your applications to use the environment to store variables other than PATH, PROMPT, and APPEND. You can use these variables to beef up your batch files, and many recent applications make use of environment variables to store path information for certain files and other variables.

For the most part, this is done with the SET command, using the format SET name=value. *Name* is simply the variable name and *value* is the text you assign to it. DOS 3.0 and earlier don't let you do much with the variables once you assign them, but 3.1 and later let you access variable values once you've loaded them in. As an easy example, enter WHEN=NOW at the DOS prompt. Then type ECHO THE TIME IS %WHEN%. DOS fills in the variable WHEN with its value, NOW.

To see how your variable is stored in the environment, along with your other environment variables, enter SET without any parameters; the results are the contents of your environment. A simple environment, including the results of our example, might read

```
COMSPEC=C:\COMMAND.COM
PATH=C:\;C:\DOS;C:\BIN;C:\LUTS
PROMPT $P$G
WHERE=NOW
```

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—WHEN for instance—enter SET WHEN=, with only a carriage return—no space—after the equals sign. Now you can type SET again. The WHEN line should no longer appear.

Getting back to the environment size, the example listed above should require exactly 80 bytes—72 characters at 1 byte per character plus 2 bytes per string for string location and delineation. If you want to verify this, you can download a copy of Richard Shaw's ENVCOUNT.COM from PC MagNet or look it up in PC Lab Notes in the April 14, 1987, issue of PC Magazine. ENVCOUNT determines the number of bytes actually used out of the environment space allocated.

Used in batch files with DOS's collection of batch commands—including a few conditional commands—the SET command can work wonders. Alas, the subject is much too involved for more than a cursory introduction here. If you're serious about getting the most out of DOS, you should pick up one of the many DOS books on the market, the best of which dedicate chapters to batch file techniques. —Mitt Jones

CHANGE QUICKLY TO 43-LINE MODE

I'm trying to write a short program I can run from dBASE to switch an EGA display from 25 lines to 43 and back again. I know it shouldn't be too difficult, yet I can't find any BIOS video calls that support such a switch. Can you help?

Jeffrey Rozenburg
North Miami, Florida



That's an easy one. Charles Petzold published a short DEBUG script way back in PC Magazine's September 16, 1986, Programming/Utilities column to switch an EGA into 43-line mode. I've reproduced it here exactly as it originally appeared. To create the file EGA43.COM, go into the DEBUG program and type the script exactly as shown in Figure 1, including the blank line that is near the end.

The key here is the call to the video BIOS made by executing an interrupt 10h with AH set to 11h and AL set to 12h. Function 11h downloads the 8-by-8 character font stored in EGA ROM and reprograms the CRT Controller for the proper

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Tutor

number of rows to be displayed, number of scan lines per row, etc.

To cover for well-documented bugs in the EGA BIOS, EGA43.COM sets the cursor and monochrome underline positions itself. Note that for this routine to work, the current video page must be page 0. If you'll be switching into 43-line mode from another page, add a call to change back to page 0 at the program's beginning.

There are a couple of methods that you can use in order to get back to 25-line mode. One is to write a short program using function 0 in the video BIOS to reset

ment in my CONFIG.SYS file reads

```
SHELL=C:\COMMAND.COM D:\ /E:512 /P
```

COMMAND.COM, which I copy to the D: drive from my AUTOEXEC file, shows up when I ask for a directory of drive D: and I don't get any error messages; but I still have to wait for my machine to reload COMMAND.COM from disk. I've heard this can be done. What am I doing wrong?

Karen Offitzer
New York, New York



You're on the right track. Unfortunately, one of DOS's quirks is keeping your plan from working. DOS allows a portion of COMMAND.COM to be overwritten in memory by applications when they need more RAM. When you exit the application, DOS must reload that portion of COMMAND.COM from a copy on your disk or other device. The COMSPEC variable, one of DOS's environment variables, tells DOS where to find the copy of COMMAND.COM to reload. COMSPEC defaults to the copy of COMMAND.COM used during boot-up, but it can be changed to point to a secondary copy in another subdirectory or on another device. The faster the device, the faster COMMAND.COM will reload.

The CONFIG.SYS SHELL command allows you to set COMSPEC, using an optional drive and path designation that follows the command processor path and name (usually C:\COMMAND.COM). However, any time you specify a value of COMSPEC, a copy of COMMAND.COM must reside on the appropriate device and at the appropriate path when DOS evaluates the command. Because DOS evaluates the CONFIG.SYS file before AUTOEXEC.BAT, and because your first chance to copy COMMAND.COM to your RAMdisk doesn't occur until your AUTOEXEC.BAT file is executed, you are, in essence, prevented from using the SHELL command to reset COMSPEC to point to a RAMdisk.

Fortunately, there is an easy solution, though it works only with DOS 3.0 and later. Take the /D: parameter out of your SHELL command and use the SET command in your AUTOEXEC.BAT file instead. But make sure to copy COMMAND.COM to your RAMdisk first. In your case, the lines would read

```
COPY COMMAND.COM D:
SET COMSPEC=D:\COMMAND.COM
```

Along the same lines, many people don't realize that it is not necessary to keep COMMAND.COM in the root directory with DOS 3.2 or later. If you simply want to unclutter your root directory a bit by making the copy of COMMAND.COM in

The COMSPEC variable, one of DOS's environment variables, tells DOS where to find the copy of COMMAND.COM to reload.

your \DOS subdirectory the boot copy, for instance, alter your SHELL statement to read

```
SHELL=C:\DOS\COMMAND.COM /P /E:512
```

Before you reboot with no COMMAND.COM in your root directory, make sure you've got a copy in your \DOS subdirectory.

You can combine the two techniques above by replacing the COPY command in the AUTOEXEC file with

```
COPY C:\DOS\COMMAND.COM D:\
```

Before you try any of these techniques, heed Murphy's Law of Tinkering and make sure that you have a bootable floppy disk handy.—Mitt Jones

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, PC Magazine, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally.

EGA43.SCR COMPLETE LISTING

```
N EGA43.COM
A 100
MOV AX,1112
MOV BL,0
INT 10
SUB AX,AX
MOV DS,AX
PUSH [0487]
OR BYTE PTR [0487],1
MOV CX,0600
MOV AH,1
INT 10
POP [0487]
MOV DX,03B4
MOV AX,0714
OUT DX,AX
INT 20

R CX
28
W
Q
```

Figure 1: This DEBUG script creates EGA43.COM, which will switch an EGA display from the normal 25 lines to 43-line mode.

the video mode. Another is simply to execute a MODE 80 command. Although it's probably not important, the contents of the display buffer will be cleared when you use either of these methods to revert to 25-line mode.—Jeff Prossie

FAST COMMAND.COM RELOADS

I've tried, but to no avail, to load a copy of COMMAND.COM into my RAMdisk and specify it as a secondary copy to speed COMMAND.COM reloads. My RAMdisk is designated as D:, and the SHELL state-

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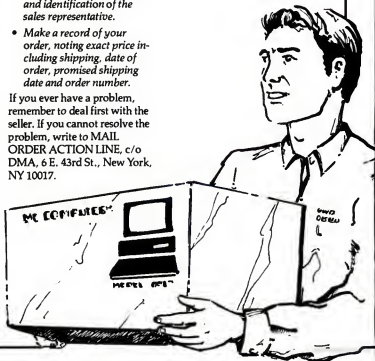
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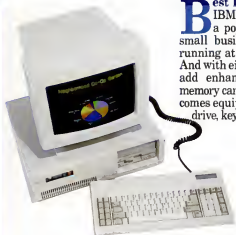
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Floppy	1.2MB (\$14)	1.44MB (\$16)	1.44MB (\$16)	1.2MB (\$14)	1.2MB (\$14)	1.44MB (\$16)	1.44MB (\$16)	1.2MB (\$14)
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 8008/286/386/486/586/686/786/886/986/1086/1186/1286/1386/1486/1586/1686/1786/1886/1986/2086/2186/2286/2386/2486/2586/2686/2786/2886/2986/3086/3186/3286/3386/3486/3586/3686/3786/3886/3986/4086/4186/4286/4386/4486/4586/4686/4786/4886/4986/5086/5186/5286/5386/5486/5586/5686/5786/5886/5986/6086/6186/6286/6386/6486/6586/6686/6786/6886/6986/7086/7186/7286/7386/7486/7586/7686/7786/7886/7986/8086/8186/8286/8386/8486/8586/8686/8786/8886/8986/9086/9186/9286/9386/9486/9586/9686/9786/9886/9986/10086/10186/10286/10386/10486/10586/10686/10786/10886/10986/11086/11186/11286/11386/11486/11586/11686/11786/11886/11986/12086/12186/12286/12386/12486/12586/12686/12786/12886/12986/13086/13186/13286/13386/13486/13586/13686/13786/13886/13986/14086/14186/14286/14386/14486/14586/14686/14786/14886/14986/15086/15186/15286/15386/15486/15586/15686/15786/15886/15986/16086/16186/16286/16386/16486/16586/16686/16786/16886/16986/17086/17186/17286/17386/17486/17586/17686/17786/17886/17986/18086/18186/18286/18386/18486/18586/18686/18786/18886/18986/19086/19186/19286/19386/19486/19586/19686/19786/19886/19986/20086/20186/20286/20386/20486/20586/20686/20786/20886/20986/21086/21186/21286/21386/21486/21586/21686/21786/21886/21986/22086/22186/22286/22386/22486/22586/22686/22786/22886/22986/23086/23186/23286/23386/23486/23586/23686/23786/23886/23986/24086/24186/24286/24386/24486/24586/24686/24786/24886/24986/25086/25186/25286/25386/25486/25586/25686/25786/25886/25986/26086/26186/26286/26386/26486/26586/26686/26786/26886/26986/27086/27186/27286/27386/27486/27586/27686/27786/27886/27986/28086/28186/28286/28386/28486/28586/28686/28786/28886/28986/29086/29186/29286/29386/29486/29586/29686/29786/29886/29986/30086/30186/30286/30386/30486/30586/30686/30786/30886/30986/31086/31186/31286/31386/31486/31586/31686/31786/31886/31986/32086/32186/32286/32386/32486/32586/32686/32786/32886/32986/33086/33186/33286/33386/33486/33586/33686/33786/33886/33986/34086/34186/34286/34386/34486/34586/34686/34786/34886/34986/35086/35186/35286/35386/35486/35586/35686/35786/35886/35986/36086/36186/36286/36386/36486/36586/36686/36786/36886/36986/37086/37186/37286/37386/37486/37586/37686/37786/37886/37986/38086/38186/38286/38386/38486/38586/38686/38786/38886/38986/39086/39186/39286/39386/39486/39586/39686/39786/39886/39986/40086/40186/40286/40386/40486/40586/40686/40786/40886/40986/41086/41186/41286/41386/41486/41586/41686/41786/41886/41986/42086/42186/42286/42386/42486/42586/42686/42786/42886/42986/43086/43186/43286/43386/43486/43586/43686/43786/43886/43986/44086/44186/44286/44386/44486/44586/44686/44786/44886/44986/45086/45186/45286/45386/45486/45586/45686/45786/45886/45986/46086/46186/46286/46386/46486/46586/46686/46786/46886/46986/47086/47186/47286/47386/47486/47586/47686/47786/47886/47986/48086/48186/48286/48386/48486/48586/48686/48786/48886/48986/49086/49186/49286/49386/49486/49586/49686/49786/49886/49986/50086/50186/50286/50386/50486/50586/50686/50786/50886/50986/51086/51186/51286/51386/51486/51586/51686/51786/51886/51986/52086/52186/52286/52386/52486/52586/52686/52786/52886/52986/53086/53186/53286/53386/53486/53586/53686/53786/53886/53986/54086/54186/54286/54386/54486/54586/54686/54786/54886/54986/55086/55186/55286/55386/55486/55586/55686/55786/55886/55986/56086/56186/56286/56386/56486/56586/56686/56786/56886/56986/57086/57186/57286/57386/57486/57586/57686/57786/57886/57986/58086/58186/58286/58386/58486/58586/58686/58786/58886/58986/59086/59186/59286/59386/59486/59586/59686/59786/59886/59986/60086/60186/60286/60386/60486/60586/60686/60786/60886/60986/61086/61186/61286/61386/61486/61586/61686/61786/61886/61986/62086/62186/62286/62386/62486/62586/62686/62786/62886/62986/63086/63186/63286/63386/63486/63586/63686/63786/63886/63986/64086/64186/64286/64386/64486/64586/64686/64786/64886/64986/65086/65186/65286/65386/65486/65586/65686/65786/65886/65986/66086/66186/66286/66386/66486/66586/66686/66786/66886/66986/67086/67186/67286/67386/67486/67586/67686/67786/67886/67986/68086/68186/68286/68386/68486/68586/68686/68786/68886/68986/69086/69186/69286/69386/69486/69586/69686/69786/69886/69986/70086/70186/70286/70386/70486/70586/70686/70786/70886/70986/71086/71186/71286/71386/71486/71586/71686/71786/71886/71986/72086/72186/72286/72386/72486/72586/72686/72786/72886/72986/73086/73186/73286/73386/73486/73586/73686/73786/73886/73986/74086/74186/74286/74386/74486/74586/74686/74786/74886/74986/75086/75186/75286/75386/75486/75586/75686/75786/75886/75986/76086/76186/76286/76386/76486/76586/76686/76786/76886/76986/77086/77186/77286/77386/77486/77586/77686/77786/77886/77986/78086/78186/78286/78386/78486/78586/78686/78786/78886/78986/79086/79186/79286/79386/79486/79586/79686/79786/79886/79986/80086/80186/80286/80386/80486/80586/80686/80786/80886/80986/81086/81186/81286/81386/81486/81586/81686/81786/81886/81986/82086/82186/82286/82386/82486/82586/82686/82786/82886/82986/83086/83186/83286/83386/83486/83586/83686/83786/83886/83986/84086/84186/84286/84386/84486/84586/84686/84786/84886/84986/85086/85186/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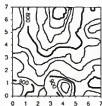
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- e. ☐ Engineering/R&D
- f. ☐ Finance/Accounting
- g. ☐ Marketing/Sales
- h. ☐ Administrative/General Management

3. Is your company a reseller?

- i. ☐ Yes
- j. ☐ No

4. For how many IBM PCs and compatibles do you specify brands of products?

- k. ☐ 10 or less
- l. ☐ 11-25
- m. ☐ 26-100
- n. ☐ 100 or more

5. Are there any PCs in your office? (Check all that apply.)

- o. ☐ Linked to mainframe
- p. ☐ Linked to mini
- q. ☐ Networked together

6. Does your company own:

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7. Do you plan to buy any PC products?

- t. ☐ Now
- u. ☐ In 4 to 6 months
- v. ☐ In 6 to 12 months
- w. ☐ No definite plans

8. Number of employees in your entire company?

- x. ☐ 25 or less
- y. ☐ 26-99
- z. ☐ 100-499
- 1. ☐ 500-999
- 2. ☐ 1000 or more

9. Are there any Macintosh computers in your office?

- 3. ☐ Yes
- 4. ☐ No

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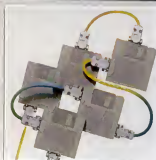


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COMING UP



■ LAN APPLICATION SOFTWARE

PC Magazine devotes an entire issue to application software for networks, focusing on products that make your LAN earn its keep by boosting productivity to new heights.

■ ACCOUNTING SOFTWARE

If any one type of application really flourishes in a LAN environment, it's accounting software. A good LAN-based accounting package will consolidate data flowing in from all parts of the company or organization and keep the inventory, pay the bills, send the invoices, and produce reports that spell out the bottom line. How well do accounting's heavy hitters perform on a LAN? Our Price Waterhouse experts benchmark-test eight top packages.

■ DATABASES

Six database powerhouses are put to the test in a networked environment to see how performance degrades under increased load. The results of PC LAN Labs' unprecedented benchmark tests may surprise you.

■ LAN E-MAIL

At just \$30 per node, LAN electronic-mail software is a low-overhead productivity booster. With a system in place, telephone tag and office memos become things of the past.

■ WORKGROUP SOFTWARE

While industry analysts debate what "groupware" is and what it isn't, *PC Magazine* takes a look at products designed to enhance group productivity through group scheduling, document sharing, and simple communications.



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The price is \$6,675 per insertion (three insertion minimum) and frequency discounts are available.

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After Hours

Products for the Leisure Side of Personal Computing

Stickybear Alphabet Uses Audio to "Talk" to Tots As It Teaches

EDUCATION
by Don Trivette

A is for airplane, B is for bird, and C is for cow. These are the first three letters of the *Stickybear Alphabet* from Weekly Reader Software, a program meant to educate and entertain the toddlers in your life. Any 3-year-old worth his or her Fruit Loops will soon learn that pressing the L key causes a lion to turn his head and roar.

Roar? Yes! *Alphabet* works with the optional Echo PC+ board (see the sidebar "Echo Card Gives Your PC a Clear Voice") to produce the roar of the lion or chirp of the bird. (Speech is readily available only with 3½-inch floppy-disk versions of the software, though Weekly Reader Software can make available the extra files



Stickybear Alphabet uses high-resolution EGA/VGA graphics.

for 5¼-inch-disk users who also have hard disks.) Stickybear himself pronounces the letter and the word: "C, Cow," he says, and then the cow moos.

Alphabet is divided into three parts. The first, called *Alphabet*, responds to the press of an alphabet key by displaying

the letter in uppercase and lowercase forms, a noun starting with the letter, and an animated picture of the word. The second part, called *Letter Hunt*, reinforces the first lessons. "Press the letter G," Stickybear says, and he rewards the correct letter response with either a tunneling

EDUCATION:

- *Atlas Explorer*: A geography tutorial.
- *The ABCs of DTP* for children.

GAMES:

- *Balance of Power* puts you in the Oval Office.
- *Arkanoid*: The arcade classic.

Echo Card Gives Your PC a Clear Voice

by Don Trivette

"Hi, I am your computer." That's what my PC says when I boot it up. The half-length Echo PC+ speech synthesizer board from Street Electronics of Carpinteria, California, was originally developed for IBM Canada for use in the IBM PS/2 Model 30s that are being placed in the public schools.

Now it's available in the U.S. (The classic base version costs \$179.95, the Micro Channel version is \$20 extra, and the Tandy 1000 board costs \$149.95.) The board installs in an expansion slot and connects to its external speaker by an 18-inch cable.

The Echo PC+ board

comes with software that lets you create speech in three ways. The highest-quality speech is achieved by digitizing a real voice. But digitized sound requires you to add an optional input adapter and a microphone (\$100), and it takes up to 8,500 bytes of memory for each second of sound.

The second mode utilizes a female voice with a predefined vocabulary of 700 words. This mode uses only 175 bytes of memory per second of sound. The manual says the female voice is quite natural sounding, but you won't mistake it for Memorex. Nevertheless, this is the technique that's used to give Stickybear his voice, and be sounds good.

The Echo's third mode is called *Textalker*; it installs as a printer (LPT1, LPT2, LPT3, COM1, or COM2) and phonetically pronounces the words in any ASCII file. After installing *Textalker* as LPT1, I used my word processor to form sentences. Everything I sent to the printer got spoken instead of printed. Rate, pitch, and intonation can be adjusted by embedding commands in the text.

Of course, the Echo can't do everything. I forgot *Textalker* was still installed until it "talked" a CAD drawing I meant for the printer. "Line feed, 6 3 2 2 1, line feed, line feed, 2 3 2 2 6 . . ." it said. That's hard to visualize.

gopher or bleating goat. The third section drills recognition and naming of the ABCs.

Weekly Reader Software has finally come out of the Dark Ages; the company used EGA/VGA graphics in *Alphabet*. The results are bright, bold, and attractive.

Without the optional sound, *Alphabet* is good; with it, it's great. Either way the program is sure to put your little ones at the head of their class when they start school. Weekly Reader Software and Street Electronics, the maker of the Echo PC+ board, are planning to bundle the two products at a discount. Check with Weekly Reader before you buy.

List Price: Stickybear *Alphabet*, \$49.95. **Requires:** 512K RAM; EGA, MCGA, VGA, or Tandy 1000 graphics adapter; DOS 3.2 or later for 3½-inch disks, DOS 2.1 or later for 5¼-inch disks. Copy protected, but hard-disk installable. Weekly Reader Software, Optimum Resource Inc., 10 Station Pl., Norwalk, CT 06058; (800) 327-1473.

CIRCLE 482 ON READER SERVICE CARD

After Hours

DTP for Kids: Limited Features Serve Tots Well

EDUCATION
by Robin Reskin

Are you man or woman enough to take the test and pit your page-layout prowess against that of your kids? With a program like *Children's Writing and Publishing Center* on their side, the kids might just snatch first prize. It's booby-proof.

This desktop publisher for the "Sesame Street" crowd offers an extremely limited but well-chosen set of functions that turns every child into a DTP success story. The larger-than-life icon-based main menu makes choosing easy.

To begin, your child selects from one of two kid-oriented page layouts: Report/Story/Letter, which has no columns, or Newsletter, which has two columns. Either of these can be created with or without "headings" (the kiddy term for headlines).

After selecting a layout, your budding DTP ace darts between the FONT icon, to choose from one of eight prezied bitmap typefaces, and the PICTURE icon, to grab one of the more than 150 well-designed

bitmap images.

The editing functions are ridiculously easy. Text can be added or deleted, or cut and pasted, all with a minimum number of commands.

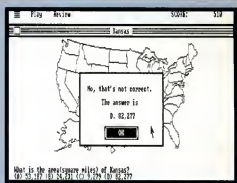
Ease-of-use does have its price, however. For example, reports are limited to only four pages in length, and newsletter files

are limited to a single page. The package doesn't support bold type or italics; it does allow underlining and centering.

Some limitations are irritating: pictures can be flipped or moved, but they can't be sized. Whoever heard of DTP in which every image is the same size? There's no support for laser printers, and you cannot vary the rigid page layouts by adding a column or even shrinking the size of a headline.

CWPC is shrewd in its nihilistic approach to features. Kids are given so little to work with that they succeed every time. The proof is in the output... big readable fonts; cute, well-rendered images of school, family, holidays, and animals; and attractive page layout. For the

Atlas Explorer offers multiple-choice quizzes that test your knowledge of the world.



very young, CWPC is an engaging entree to a world of mixed text and graphics.

List Price: *Children's Writing and Publishing Center*, \$69.95. **Requires:** 384K RAM, graphics adapter, parallel dot matrix printer, DOS 2.0 or later. The Learning Company, 6493 Kaiser Dr., Fremont, CA 94555; (800) 852-2255.

CIRCLE 423 ON READER SERVICE CARD

Atlas Explorer Reviews Facts Of World Geography

EDUCATION
by Don Trivette

One out of seven of our 18- to 24-year-olds cannot identify the United States on a world map, and 30 percent can't find the Pacific Ocean. Statistics like these prompted Springboard Software to develop *Atlas Explorer*, a geography tutorial for school and home instruction.

Atlas Explorer is a collection of maps and data that covers the continents and countries of the world plus the states of the United States and Mexico, the provinces of Canada and China, and the republics of Russia.

The program has two sections: a tutorial and a quiz. In the tutorial mode you point and click on a country, and AE tells you its capital, population, area, language, and a few other details. After you've reviewed all the countries in an area, you

can select the quiz option.

In quiz mode, *Atlas Explorer* pops one question after another onto the screen, and you pick the answers by clicking on the map location or on one of four multiple-choice questions. The program awards points for accuracy and speed.

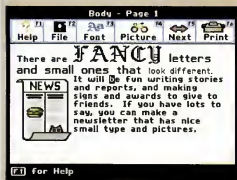
There are some gaps in AE's view of the world. Many islands in the Pacific, for example, appear as unnamed black dots. Lakes, rivers, and mountains are missing. Anyone expecting the detail and scope of a printed atlas will be disappointed. On the other hand, there's no sense worrying about rivers if you can't find oceans.

In the quiz, there is a misplaced emphasis on accuracy, which is caused by letting the computer randomly select the incorrect multiple-choice answers. Only my sixth grade geography teacher would care whether the population of Port-au-Prince is 597,512 or 589,100.

Atlas Explorer operates on three old-fashioned principles: drill, drill, and drill. With geography lessons and flash cards as near as the keyboard, there's no longer any excuse for not knowing the location of Belize or the capital of Nepal.

List Price: *Atlas Explorer*, \$49.95. **Requires:** 512K RAM, graphics adapter, DOS 3.0 or later. Mouse recommended. Springboard Software Inc., 7808 Creekside Circle, Minneapolis, MN 55435; (612) 944-3915.

CIRCLE 424 ON READER SERVICE CARD



Children's Writing and Publishing Center helps youngsters turn out documents with text and graphics.

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After Hours

Balance of Power: You Decide the World's Fate— War or Peace?

GAME

by Jennifer Zaino

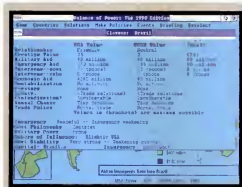
Balance of Power—The 1990 Edition (\$49.95 from Mindscape) is a game for everyone whose mother wanted him or her to grow up to be President of the United States. After playing a few rounds, though, you may be awfully glad that Mama didn't get her wish.

Not that *Balance of Power* doesn't provide stimulating, thought-provoking entertainment. This is one software game that challenges your intellectual skills and political savvy rather than your shoot-'em-up expertise. The sequel to the original *Balance of Power* enhances the challenge with a database of facts updated to 1988, additional countries, and a multipolarity feature.

The program also makes it clear that the President of the United States does not have an easy or enviable job. As President, you must take the world safely from 1989 to 1997, keeping a sharp eye on an ever-changing international scene. To win the game, you must accumulate more geopolitical prestige points than the Russians. (You also have the option to play as the U.S.S.R. or to play against another human opponent rather than the PC.)

Play takes place on a map of the world. On the beginner, intermediate, and expert levels, play is on a bipolar basis—the U.S. and the U.S.S.R. are the primary role players. On the multipolar level, the computer also provides secondary countries with active roles.

At the beginner level, you spend most of your time encouraging insurgency in unfriendly countries or providing military or financial support to friendly governments. Later, you have



In *Balance of Power* you can study helpful data, but final decisions come from you and only you.

to deal with coups d'état and the possible Finlandization of other countries. You'll also be able to flex your muscles by making treaties or altering your trade policies.

I must confess to occasionally finding myself confused by the political maze. For instance, I was providing the Sandinista government in Nicaragua with military and economic aid (hey, this is a game, not real life) when the Sandinistas were toppled by the Contra insurgents. In such instances, the game automatically switches your financial and military support over to the new rebels, the Sandinistas. However, the favorable trade policy I negotiated for the Sandinistas remained in effect under the Contras. I had to manually institute a new trade embargo so that I wouldn't defeat my own purposes.

The game provides a panel of four advisers to help you with some of the tough questions, such as what to do when the U.S.S.R. sends \$200 million in military aid to India. But in the end, the pressure is on you to make the hard decisions. You can force an issue by posing anything from a polite diplomatic question to a military threat. You can even go so far as to instigate nuclear war.

Should that last, fatal event occur, *Balance of Power* bumps you out of the game and right back to DOS. But this is a game with a social con-

science—you'll be sharply reprimanded for blowing up the world.

The game runs under *Microsoft Windows* (you can buy a runtime version from Mindscape for \$15)—so a mouse is virtually a necessity. In addition, screen redraws and recalculations are sometimes plodding on an AT-class machine. In its quest to improve speed to some extent, the game also requires 512K of RAM.

It is annoying to have to select the next turn option—which advances you into the next year—in order to save the game during play. This was especially irritating the few times the game simply froze up, destroying everything I'd done since the last save.

I also was befuddled by some inconsistencies—for instance, some countries that were pinpointed as at risk for Finlandization under the Major

Events option were not at risk under the Closeup or Finlandization (USA or USSR) options. In addition, the game's history graphs—which display your relations with a country over the years—are somewhat difficult to interpret.

The manual is a must-read. It not only reviews game options and how to use them, but it also explains why the computer reacts to your challenges in certain ways.

Balance of Power's complicated intrigues will satisfy anyone who wants to dip into the political waters without running the risk of drowning. But be prepared—keeping a handle on the world situation is sometimes like swimming upstream, against the current.

List Price: *Balance of Power—The 1990 Edition*, \$49.95.
Require: 512K RAM, *Microsoft Windows 2.0*; Mindscape Inc., 3444 Dundee Rd., Northbrook, IL 60062; (312) 480-7667.

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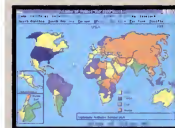
Arkanoïd Tests Your Reflexes, Coordination, And Patience

GAME

by Lori Grunin

When I was still in school, a friend led me down to the subterranean video arcade beneath our student center. There, by the unearthly glow of money-eating machines, she revealed to me her secret life as an *Arkanoïd* junkie.

I couldn't spare the quarters
CONTINUES



The map of the world is your playing field in *Balance of Power—The 1990 Edition*.

After Hours

Arkanoid

CONTINUED

necessary to follow in her footsteps then, but alas for my leisure time now, Taito Software has done a very good job of porting *Arkanoid* to the PC. The \$34.95 game is similar to *Breakout*. You try to destroy patterns of multicolored bricks by bouncing an energy ball off a paddle.

To complicate matters, random objects (ostensibly aliens, but they look more like complex molecules) deflect the energy ball. Catching other falling objects changes your capabilities. For example, one such catch awards a bonus paddle.

Arkanoid runs best on a relatively well endowed system. In EGA mode, the graphics are great, but in CGA the game is

unplayable—it's too difficult to differentiate between important screen objects. Since the paddle moves laterally, a mouse is the best possible input device. A joystick works well too, but you

can forget the keyboard.

The game has several flaws. Not only does Taito's copy-protection scheme preclude hard disk installation, but if your disk becomes corrupted in

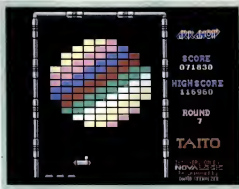
any way, the game won't run.

The third round, in which you weave the energy ball through a maze of indestructible bricks in order to destroy the others, is too difficult for so early in the game. Taito could allay much *Arkanoid*-induced hysteria by including the ability to start at any level—a feature present in the Amiga version (ported by Discovery).

When I first saw *Arkanoid*, I remember thinking what a silly, simple-looking game it was. After 4 *Arkanoid*-obsessed months, I sheepishly recant. Silly, maybe; simple, no. Addictive? Definitely.

List Price: *Arkanoid*, 3½-inch floppy disks, \$34.95; both 3½- and 5¼-inch floppy disks, \$37.95. **Requires:** 512K RAM, graphics adapter, DOS 2.0 or later. Taito Software Inc., 267 W. Esplanade, North Vancouver, British Columbia V7M 1A5, Canada; (604) 984-3344.

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Arkanoid offers more than 30 screens, which vary in difficulty from fairly easy to nearly impossible.

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